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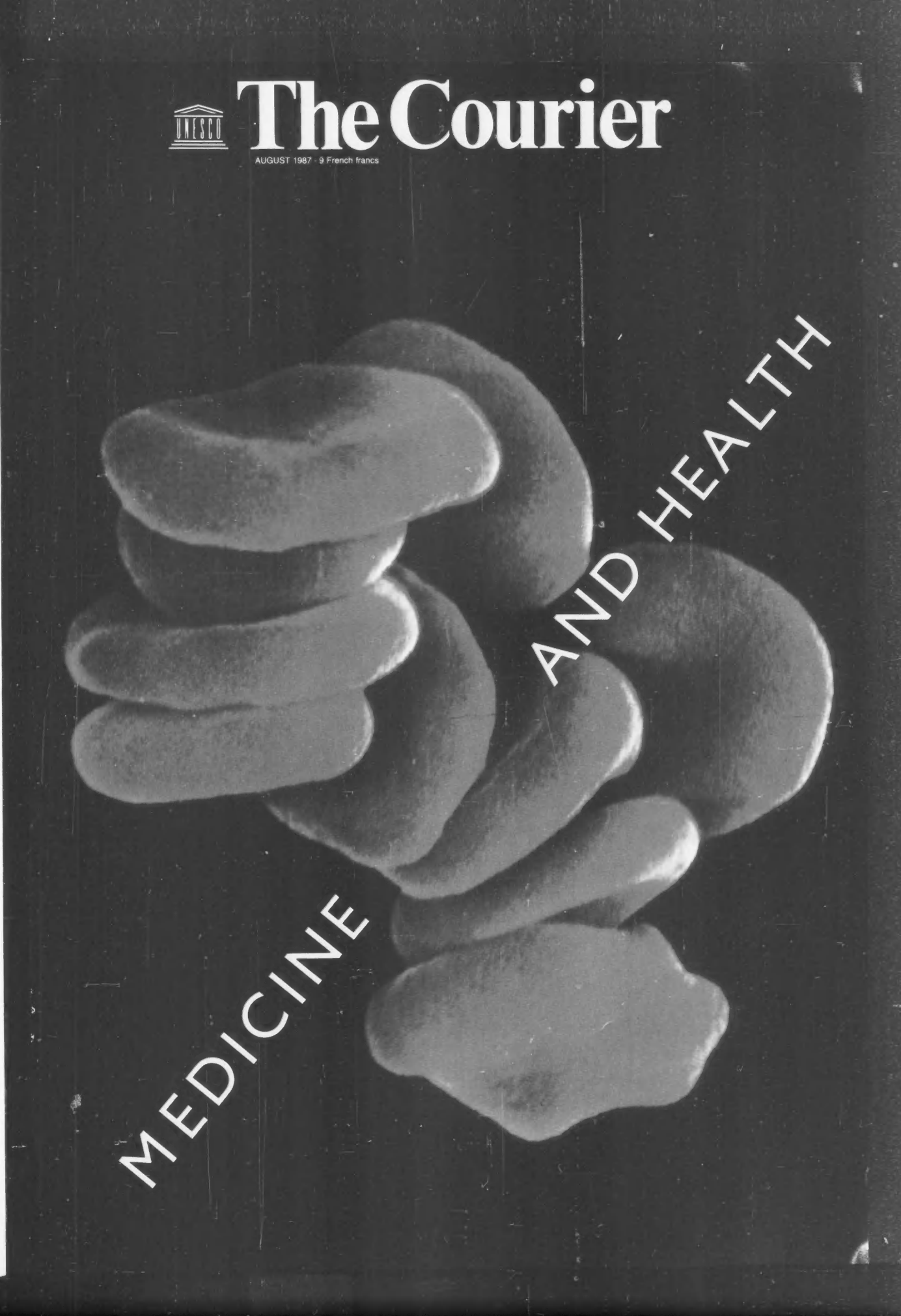

MEDICINE AND HEALTH

A time to live ...

Photo © Corneille Jest, Paris

Himalayan herbalist

An itinerant traditional doctor sits at the roadside in the Himalayan kingdom of Bhutan. Displayed on the ground before him are packets containing herbal remedies which he has prepared from plant extracts according to the principles of traditional Tibetan medicine. Scientific studies are today being carried out to explain the curative phenomena associated with the traditional use of herbal medication.

Editorial

How healthy is the world's population today? Has world health improved as a result of the amazing technical advances of modern medicine and pharmacology? Are industrialized and developing countries drawing equal benefit from progress in medical science? Do all peoples attach the same importance to health problems? Do doctors have the same perceptions of health and disease as their patients? Some answers to these and other related questions are suggested by the contributors to this issue of the *Unesco Courier*.

While many infectious diseases can now be controlled by immunization, or have been completely eradicated as in the case of smallpox, new diseases and pathological conditions have arisen, often associated with malnutrition and insanitary conditions, as well as with hitherto unknown viral strains such as the human immunodeficiency virus (HIV), which today represents an unprecedented challenge to international public health. Even increased life expectancy through improved health care creates a need for costly treatment of degenerative conditions.

A pluralistic approach to medicine and appropriate care for the individual, with consideration given to psychological and social factors as well as to biological problems, may be the only way ahead for medicine if everyone is to benefit from its new technology. In China, for example, the condition of the entire body is taken into account when treating cancer with a combination of traditional medicine, radiotherapy and chemotherapy.

The concept of preventive medicine, gaining ground everywhere and especially in developing countries, is basically linked to local systems of primary health care, the family and community support, which can take some of the burden from overstretched medical services, as would a more rational use of pharmaceutical products.

What does the future hold? Will cures for all human ills eventually be available, limited only by economic resources? Perhaps, but breakthroughs in biotechnology, neurology, genetic medicine, research into new vaccines, advanced therapies such as molecular, micro, or "spare-part" surgery, and all other aspects of "hi-tech" medicine, are only part of tomorrow's medicine. Twenty-first century health care should continue to be based on prevention of disease and on meeting basic human needs for nutrition, hygiene, shelter and education.

Cover: Red blood corpuscles (erythrocytes) photographed with the aid of a scanning electron microscope. Photo © Centre National de Recherche Iconographique (CNRI), Paris

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40th year

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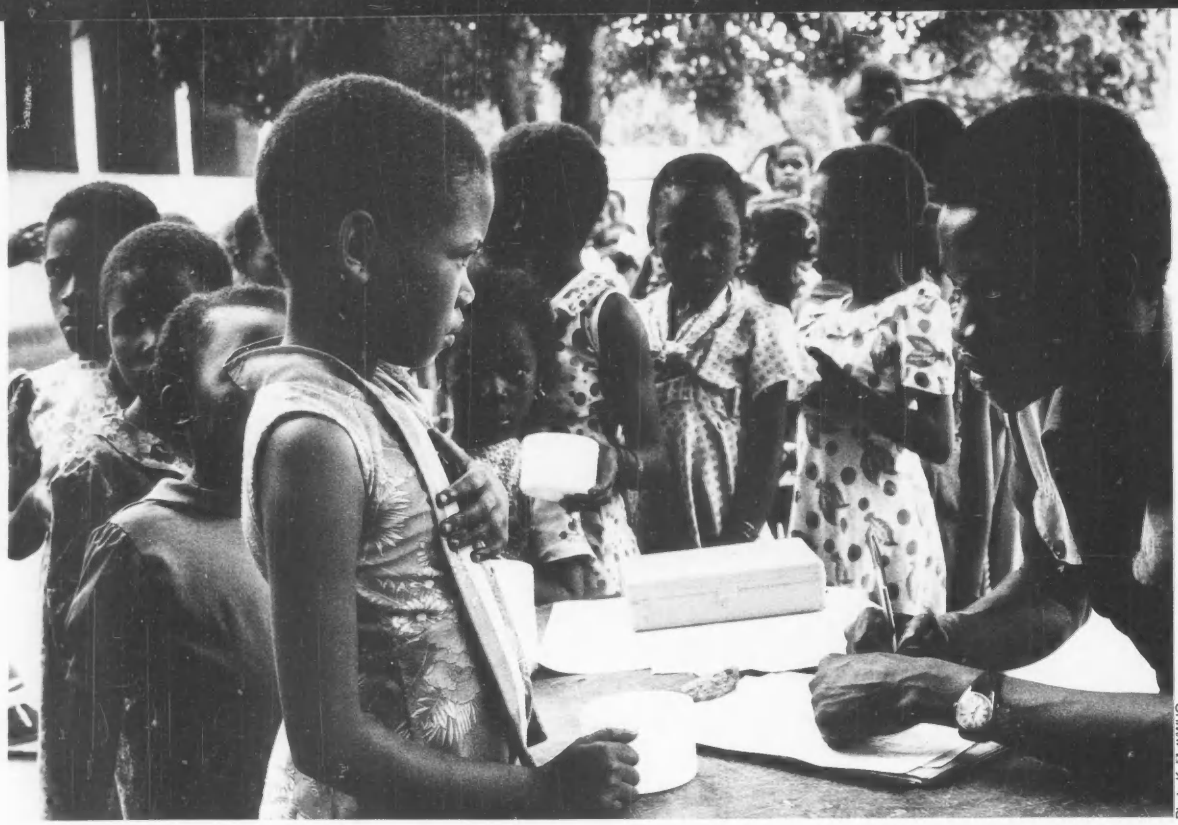


Photo K. Mott/WHO

The notion of health

by Paul Gigase

AT first sight, the concept of health seems perfectly straightforward. In 1946, the World Health Organization (WHO) set forth the following definition in the preamble to its Constitution: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." However, this definition is qualified in the next paragraph, which speaks of the "highest attainable standard of health" as a fundamental human right, thus taking into account limiting circumstances such as congenital handicap, or the serious consequences of disease or accident.

The WHO definition reflected a reaction against the usual view of health as the mere absence of disease. Nevertheless, it implies that there is such a thing as a universal, ideal state of health. Is this really the case? How is health perceived by sick people, medical staff and ancillaries, non-professional health workers and even healers?

A doctor is interested in disease: in other words, in a deviation from the somatic or psychic norm, which he or she is able to bring to light, sometimes without the patient's knowledge. A doctor will often be less concerned about the way in which a patient perceives and interprets his or her disease, and this attitude is encouraged by the impressive advances made in medical technology. However, what is abnormal is only a deviation from a statistical average, and the greater the number of parameters on which the assessment of the state of health is based, the more chances there are that subnormal values will emerge, without necessarily indicating a state of disease. Moreover, these criteria are not absolute: malaria, for example, causes an "abnormal" swelling of the spleen in infected children, which is in fact a sign of the body's healthy defensive reaction to the disease. In regions where malaria is endemic, it would be more alarming to note the absence of any swelling of the spleen in these children!

When the cause of a disease is well known, the doctor will attempt either to use preventive measures or to diagnose the disease as early as possible, at a time when treatment will still be effective and will not leave irreversible after-effects. This is primary or secondary prevention. Doctors will accordingly ask their patients to give up some habits or adopt new ones—in other words, to change their way of life to a certain extent, in the knowledge that the effort required will benefit only some of them, as in the case of smokers and lung cancer. But the patient sees in this only a restriction of his or her immediate well-being for the sake of a remote and hypothetical improvement in health.

Sick peoples' perception of their disease is shaped by the disturbances that it causes in their everyday well-being. Their perception of the disease, their awareness of that perception and the form that their reaction takes belong in a particular context and find expression in behaviour which would be incomprehensible to any professional who

Drawing L. Chitsulo

Schistosomiasis (also known as bilharziasis after its discoverer Theodor Bilharz) is a parasitic disease which affects about 200 million people in many tropical and subtropical developing countries. The disease is transmitted via freshwater snails which carry and spread the parasite. Blood in the urine, kidney damage, bladder cancer and liver failure are some effects of the disease. Today schistosomiasis can be diagnosed using simple, low-cost techniques to detect parasite eggs in the urine or faeces and patients can be treated immediately with an orally taken drug. Left, children with urine samples line up for testing. Above, health education drawing used to help people understand the disease and discourage them from contaminating water.

the walls of the bladder; they are acquired, in tropical regions, through contact with water polluted by the urine of infected subjects. The more numerous the worms, the more acute the symptoms of the disease. The symptoms appear primarily in the form of haematuria, or the presence of blood in the urine, which becomes red—either permanently, or after physical effort. In a region where urinary schistosomiasis does not exist, haematuria is a somewhat rare and always alarming symptom.

In regions where urinary schistosomiasis is endemic, on the other hand, most of the population is infected, and haematuria is frequent. Schoolchildren—particularly boys, who are more readily allowed by their parents to bathe and play in water—are the worst affected. As a result, their urine often becomes red at puberty. Hence the idea, tenacious in certain ethnic groups, that the presence of blood in boys' urine is the equivalent of menstruation in girls, and that its absence, rather, would be abnormal at that age.

As the children grow older, their contacts with water become fewer; similarly, the quantity of worms of which they are carriers diminishes, and so does the haematuria. They are eventually cured, although some of them suffer from serious after-effects of their infection and, if no treatment is given, they may die of these much later. No connection is made between these later deaths and haematuria in childhood, a fact which accounts for the off-hand attitude displayed towards this symptom.

Haematuria in a young person in a region where urinary schistosomiasis is endemic is almost certainly due, whatever form it takes, to infection by flatworms. However, people may perceive it as several different disorders, having a variety of causes. In West Africa, for example, short attacks of haematuria are often attributed to exhausting work or to the consumption of indigestible food. Some symptoms may be interpreted as signs of a venereal disease caught by stepping in the urine of an infected person or animal, or of a liver disease passed on

Malaria is one of the world's most widespread, devastating diseases. More than half the world's population lives in endemic areas, and an estimated 8 to 9 million people die from the disease every year. Earlier hopes of eradicating malaria with drugs and insecticides were dashed by the development and spread of drug-resistant malaria parasites and of insecticide-resistant mosquitos carrying the parasites. Now the emphasis is on control, rather than eradication. Strong hopes are pinned on new drugs, vaccines and novel vector control methods. Right, malaria surveillance workers in India take blood samples from suspected cases.

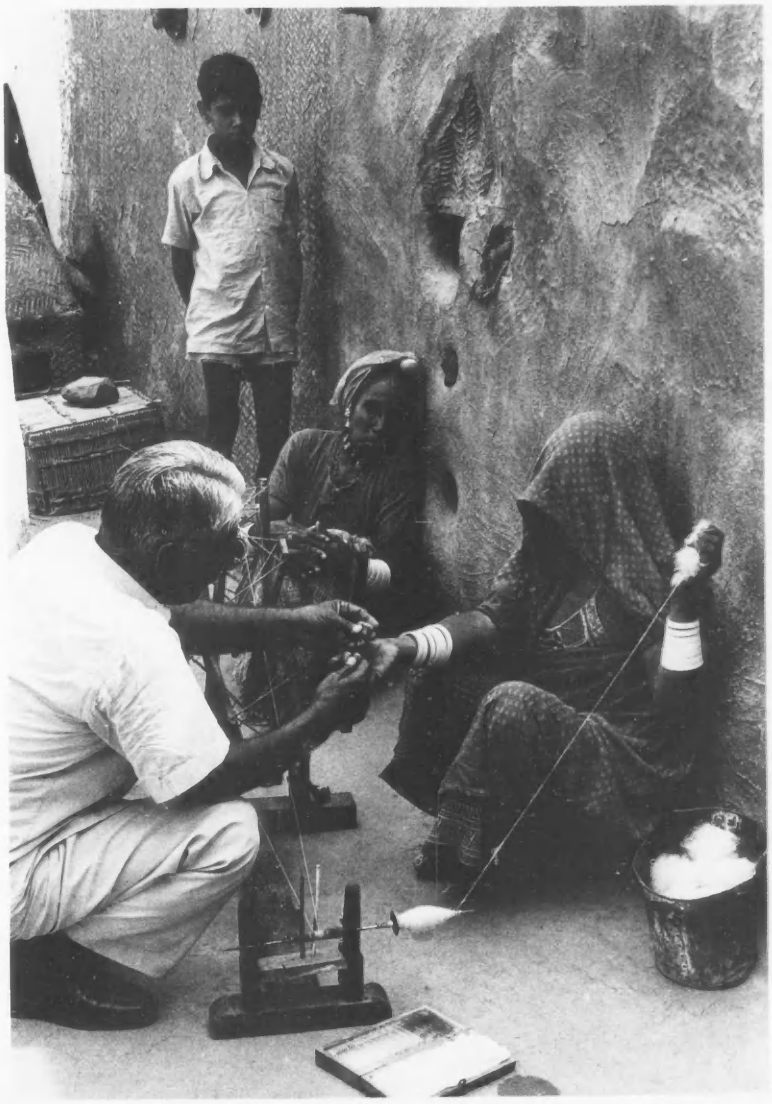


Photo A.S. Kochar/WHO

failed to take that context into account, especially since it often happens that no objective cause is found for the feeling of being unwell. Awareness of disease is a function of previous experience, of something unusual, of the average standard of health enjoyed by other people, of the beliefs and traditions current in the community, of the ethnic, religious and ideological affinities of the sick person—in short, of a network of cultural factors.

Let us imagine, for example, that I suddenly and unexpectedly find that I have aged thirty or forty years. At the very least, I will feel unwell, or even really ill, whereas my state will seem quite normal to me when I have reached that age by natural degrees. Similarly, the side-effects of pregnancy are much more tolerable as such than if they were to occur in other circumstances.

Urinary schistosomiasis provides a good example of the ways in which a disease may be perceived. This condition is caused by small flatworms which attach themselves to

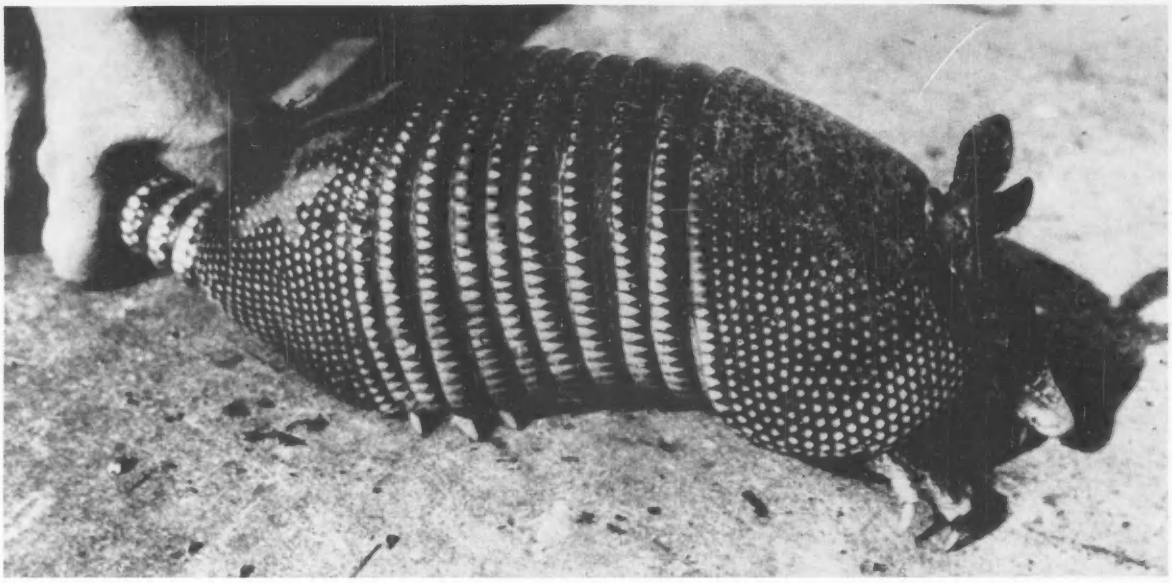


Photo WHO

Still endemic in many tropical countries, mainly in Africa, Asia and Latin America, leprosy affects nearly 11 million people. Research into the causes, treatment and prevention of leprosy has been slowed down because scientists have so far been unable to grow in laboratory conditions the bacillus that causes the disease. The discovery that the bacillus could be grown in large numbers in the nine-banded armadillo, above, was an important step forward in the study of immunity to leprosy and opened the way to new developments in the search for a leprosy vaccine.

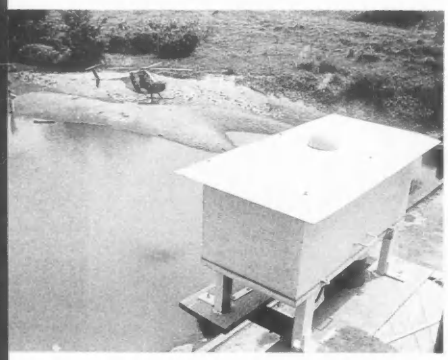


Photo John Bland/WHO

River blindness (onchocerciasis) is caused by minute worms transmitted to humans by small black flies that breed in fast-flowing water. An estimated 40 million people are affected, mainly in Africa. To control river blindness in West Africa helicopters spray blackfly breeding sites with larvicide chemicals as part of the Onchocerciasis Control Programme (OCP) carried out by WHO. In 1984 OCP launched an experimental project using satellite telemetry transmissions to determine in advance how much insecticide must be used at different points. Transmitters were set up to register the depth and flow-rates of several rivers. They send this information via satellite to a receiving station where it is processed by computer and given to the pilots before they take off. Above, a data transmitter affixed to a bridge. In background, an OCP helicopter.

either by flies or by a pregnant woman to her child if she breaks certain taboos. Each manifestation of the symptom is given a specific form of traditional treatment.

The importance attached to a health problem may not be the same for the individual as for the community. The seriousness of a disease depends on many factors, such as frequency of occurrence, the number of deaths that it causes, the age at which it is most common, or the temporary or permanent disability that it may cause. A disease or disorders which are very widespread will be felt to be a problem of greater concern to the individual than a deadly disease which affects only a small number of people, even if the latter is, objectively, a more urgent problem; and preventive measures will be more readily accepted in the former than in the latter case.

So doctors and their patients do not speak the same language, and this is a fundamental cause of the universal malaise in medicine. The developing countries have opted resolutely for a policy of primary health care, in accordance with the recommendations of the Alma-Ata Declaration.[1] Participation by the population is an essential part of this grass-roots strategy. The problem is how to make the best use of limited resources to meet the needs assessed by professionals and the demands expressed by the population. When someone perceives that he or she has a health problem, this should, according to the planners' way of thinking, induce the patient to turn to the established system for help.

But reactions to discomfort or disease are not always predictable. The possibilities are legion: people may have recourse to their families, friends, hawkers of medicines, healers, herbalists, fortune-tellers, charlatans, and so on. Equally numerous are the obstacles blocking access to the health services: distance, financial circumstances, and the social and cultural gap between those dispensing medical treatment and those seeking it.

Traditional or popular medicine is more readily available; it speaks a language comprehensible to patients and follows a logic that they can understand. So it is hardly surprising that alternative medicine is so popular, both in the developing countries and in the industrialized countries. Patients are often more satisfied with it than with conventional medicine, even if objectively it does not improve their state of health. A less marked difference in social status, the emphasis placed on explaining causes and the way in which these explanations tally with the patient's own views on the circumstances and mechanisms of his or her disease are all valid reasons for the popularity of alternative medicine. The fashion for diets or other recipes for health, often ill-judged, which are advocated in the media by non-specialists, suggests that this popularity may also spread to preventive medicine.

It would be wrong to suppose, particularly in preventive medicine, that health—at least as long as a person has it—is always at the top of that person's scale of values. More often, social advantages and convenience and comfort in everyday life are put first.

All this points to two conclusions: first, that it is necessary, before setting up a system of health care, to evaluate all its aspects, including the way in which its intended beneficiaries perceive health and disease. Secondly, doctors should treat and prevent disease not only as they see it, but also as the patient experiences it, which is, indeed, something that good doctors have always done. ■

1. In 1977, the World Health Assembly, the governing body of WHO, adopted a universal aim: "Health for all by the year 2000." In 1978, an International Conference held in Alma-Ata (USSR) declared that Primary Health Care was the means of achieving that aim. Health care systems based on urban medical facilities had been judged disappointing. A new strategy, founded on basic medical care and health education, and giving priority to rural areas, was to be followed. *Editor.*

PAUL GIGASE, *of Belgium, is a specialist in tropical diseases and professor at the Institute of Tropical Medicine, Antwerp, and at the University of Ghent. He is president of the Belgian Tropical Medicine Society and has served as consultant to the World Health Organization (WHO).*

'Let the days come in'

Magic and medicine of the Maya

by Jesús F. García Ruiz

Photo © Jesús F. García Ruiz, Paris

Among the Mocho divination plays a part in medical diagnosis. Above, a healer examines the disposition of seeds to help him diagnose an illness.

THE Maya languages of Mexico and Guatemala have no specific term to designate the state of illness. A person may be in one of two states: *s-kaw-al-i:l (kaw* meaning sturdy, strong, whole) or *kam-i (kam* meaning inert, dead, not firm). This contrast between living and dead is the basis of another series of connotations: a living person is "someone who has days within him", that is, there is time ahead to live. A sick person is "someone who has no days", that is, his or her days are numbered. The same image appears in the word for "cure"—the Mocho Indians of Mexico use the expression *oksa c'a'ik,* literally "to cause the days to come in".

Moreover, the term used for the concept of being ill is *kamela:l* (to die): sickness is likened to death. The same term is used both for the "disease that is present in the world"—the harm that can produce disease—and for the sick person.

Diseases are divided into two broad categories, corresponding to the two natural components of the Mocho conception of personality:

1. *Kamela:l smani:l* (disease of the body)

This is the kind of disease that affects only externals, which "lightly touches" the person but does not "take hold" or "get in". The Mocho believe that such illnesses as head colds, muscular pains, cuts and minor skin eruptions are caused by the fact of "not taking care of yourself". They are usually local ailments that clear up quickly. This last point is important, for a disease of the "body"—which is not serious—may become a disease of the *cahci:l*—which is serious—if it persists or becomes chronic.

2. *Kamela:l cahci:l* (disease of the vital force)

In the Mocho language, *cahci:l* means the dim, uncertain light common in foggy weather, at dusk or at dawn. In reference to a human being, it describes the vital force that is contained in the blood and which, during the night, leaves the body of a sleeping person to wander in the world of the dead with the other *cahci:l* who are still alive.

Diseases affecting the *cahci:l* are always regarded as serious; they destroy a person's physical, psychic and social wholeness. These are pathological states in which the disease "gets in" and "takes hold", manifested in two kinds of symptoms: physical (tachycardia, diarrhoea, pallor, anorexia) and psychosomatic (inability to speak, depression, nervous troubles, amnesia).

This second category includes diseases with strong cultural connotations with their own special pathology, for example:

- *Siwel* (fright), is the syndrome following a sudden encounter which makes a person "jump" and produces a state of fear and agitation. Such a state may be caused by an animal (a dog or a snake), a natural phenomenon (lightning, thunder) or an accident (falling into a river). The person falls ill because fright allows part of the *cahci:l* to escape and "lose itself", and so he or she gets weaker every day. Recourse must then be had to the *qamam* ("defender"), in order that he may "put out an appeal" for the *cahci:l* to return and make the sick person whole again.
- *Ka:h'i'q* (air), which to the Maya is an separate element charged with positive and negative forces. The air contains sorcerers' spells and words which express people's bad feelings and jealousies. If air that is charged with negative forces enters the body, it may cause illness.

Illnesses due to "fright" or the "air" may be the fault of the gods or of man. Specialist healers have to decide on the aetiology of the disease and establish a diagnosis. Diseases which affect the body alone do not require the attention of a healer; they can be treated by an old woman or a *poso:m* (someone who has a knowledge of herbs). Diseases of the *cahci:l*, on the other hand, are entrusted to a healer, who acts in various ways:

- First, as an *ico:m* (diviner), to determine the causes of a disease and make a diagnosis, by divination, or by studying the *miches* (seeds). He also analyses patients' dreams and their relationships with other people.
- Second, as a *po:mo:m* (someone able to offer prayers and incense), he makes offerings to the gods and helps patients to get rid of guilt feelings and to regain confidence in themselves. He understands the use of traditional herbal remedies, and if necessary uses some modern medicines.
- Finally, as a *qamam* (defender), he looks after his patients and, with a combination of ritual and traditional phytotherapy, gives them constant support. In this way he is responsible for patients' health and for defending them from a sorcerer's spells or from the "jealousy" of an "enemy". ■

JESUS F. GARCIA RUIZ, *of Guatemala, is a doctor of ethnology who is currently a research officer with the French National Centre of Scientific Research (CNRS). He is the author of many books and articles published in international reviews.*

Does wealth equal health?

by Denis-Clair Lambert

Photo WHO/ILO

An estimated 60 per cent of the world's women have no adequate medical assistance, either during pregnancy or in childbirth. Above, traditional birth attendants being trained in Ecuador. Even short training courses can bring a sharp drop in perinatal mortality.

SINCE the Second World War, production in the developing world has grown at a much faster pace than in countries which were industrialized long ago. With an average growth rate of 5 per cent per annum during the past thirty years, the developing countries have quadrupled their output and increased their share of world production. Over the same period, they have experienced galloping population growth, without confirming the Malthusian hypothesis according to which a growing population will inevitably get poorer.

The countries whose population has increased most rapidly (such as Brazil or Mexico, where it has doubled in twenty-five years) have achieved much faster economic growth than those, such as India or Argentina, where demographic growth has been slower. Per capita income has risen by 3.5 per cent a year, and is three times higher than it was in 1960. And although average incomes have been declining since 1980 in regions such as the oil-producing Middle East, Latin America and Africa south of the Sahara, they are still rising very steeply in Asia.

The health situation is also on the whole encouraging, although the progress observed must be qualified in two respects. Firstly, the toll taken by wars and violence remains concealed and does not appear in the statistics. Secondly, the accuracy of the figures depends on the size and modernity of statistical services, and on the objectivity of the information provided. Extremely unsystematic registration of deaths can produce a false impression of an improvement in general health. Nevertheless, in the past three decades, the infant mortality rate has fallen by 60 per cent—it is now half of what it was in Brazil, one-third in China and one-tenth in Hong Kong—and overall mortality risk has rarely increased, even in the poorest countries.

The developing world is by no means homogeneous. In a survey conducted in 1982 on ninety-nine developing countries, the American demographer John Caldwell drew attention to the diversity of conditions in those countries where a steep decline in mortality rates has been observed. He singled out ten factors which he compared with mortality indicators in order to find out whether there was any correlation between them. Whereas the correlation between per capita income and infant mortality was not statistically significant, two other factors appeared to be crucial: education, especially of girls, and the prevalence of family planning. Caldwell concluded that there are two contrasting groups of countries, which he called "superior health achievers" and "poor health achievers" respectively. In each group, there are poor countries and rich countries. What is the reason for these divergencies?

The most rapid gains in life expectancy appear in regions where average **food supplies** exceed the minimum norms laid down by the Food and Agriculture Organization of the United Nations (FAO). In the past two decades, the per capita food supply has increased. This trend is particularly apparent in Asia, where the benefits of the Green Revolution (see the *Unesco Courier*, March 1987) appeared earlier than in Latin America. In Central America, the Caribbean and the Andean countries, precarious food situations have been to some extent instrumental in maintaining higher death rates. However, the most densely populated countries of the region, such as Brazil and Mexico, have achieved notable improvements in life expectancy.

Standards of living in countries where there has been a rapid improvement in the health situation are twice as high in Latin America and Southern Europe and four times higher in Eastern Asia than they were twenty years ago. The density of medical and hospital coverage has greatly increased. The ten or more semi-industrialized countries in these three regions consume far more pharmaceutical products than the rest of the developing world. Immunization, the availability of antibiotics and access to medical care all make for efficient treatment and prevention of disease.

Action to reduce the death rate in a population which is in the early stages of a demographic revolution must be taken in the first few years of life. In this demographic situation, where on average 45 per cent of deaths are of children under the age of five, infant and juvenile mortality can be reduced without substantial investment. It is here that densely populated and easily accessible areas enjoy a considerable advantage.

Poor islands such as Sri Lanka, and relatively rich ones such as Trinidad, have succeeded in less than a generation in achieving the kind of mortality rates found in European countries. So have cities such as Hong Kong and Singapore, where the male death rate is comparable to that of Sweden. The excessively high death rates recorded over very extensive areas, in Brazil or in Mexico, for example, are a result of imbalances in land-use planning—pockets of poverty in the Brazilian *Nordeste*, demographic vacuums in the interior and inequalities in the density of medical coverage.

As Caldwell shows, there is a close correlation between **female education** and **family planning**, and a reduction in the infant mortality rate. Advances in education and falling death and birth rates are also associated with the **employment** situation. One out of every two or three adults in the cities of Latin America and Africa is unemployed, and it is abundantly clear that unemployment goes hand in hand with the disintegration of the family and the precarious living conditions which make for high rates of mortality and disease.

Health and preventive care policies

The economic and social systems of countries whose health situation has rapidly improved are so diverse that few analogies can be drawn. Wealthy Kuwait has achieved a very rapid decrease in its mortality rate by deploying substantial medical resources and providing free health care. Sri Lanka has won equally impressive results with a medical coverage density

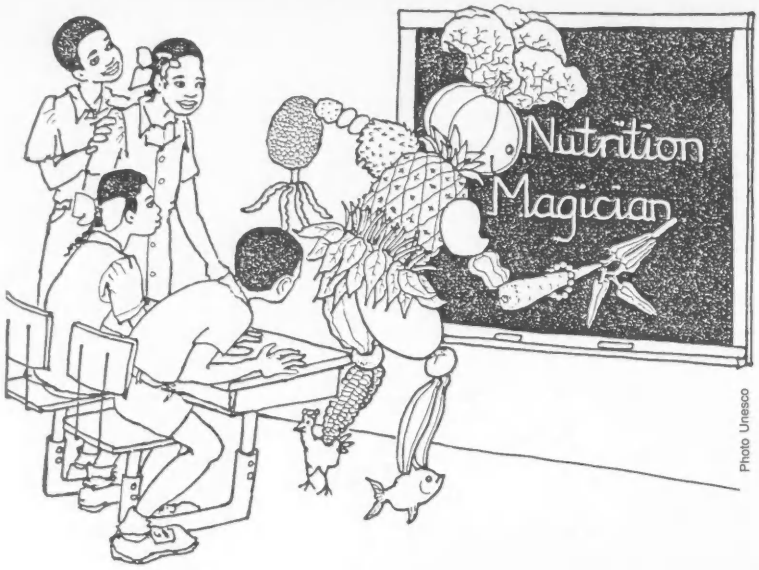


Photo Unesco

A "nutrition magician" is a central character in a new reading primer produced as part of an experimental project to incorporate nutrition education into the Jamaican primary school reading syllabus. Left, cover design of the primer, prepared by the International Nutrition Consultant Service (INCS) in association with the Jamaican Ministry of Education and with support from Unesco and the United States Agency for International Development (USAID).

Lecture on birth control at Ban Sankamphang (Thailand)

Photo C. Chi/WHO

three times less than that of India—where, incidentally, the province of Kerala has achieved remarkable improvements which are not commensurate with its standard of living, health budget or number of doctors. In Central America, the health indicators of Costa Rica have puzzled observers for some time.

The most spectacular results, however, are those of East Asian countries. The American economist Harvey Leibenstein has suggested that these baffling exceptions could be interpreted by reference to an "efficiency factor X" resulting from the spirit of enterprise and initiative shown by the people who live in these countries. More recently, another economist, Thomas Sowell, has looked closely at international migrations. The speed of assimilation of displaced Asian communities, for example, may be due partly to family cohesion, eagerness to learn and foresight.

It is noteworthy that recourse to social security or national health services is relatively low in Eastern Asia. Household saving rates are high (the average Singaporean saves more than the average Swiss). Hygiene, education and general precautions help to prevent accidents and illness. Advice about prevention is effective only if the family unit functions as a prevention centre.

"Poor health achievers"

These are countries whose health indicators are much worse than their economic indicators. Some oil-producing countries, for example, have the same health indicators as African countries ten or twenty times poorer than themselves. The same situation arises in Central and South America, where, in countries which have shown good medical results for many years, gains in health have become minimal. Poor health achievements are related to factors which are at variance with those mentioned above.

If we take infant mortality rates greater than 100 to 150 per thousand in 1985 (and if we exclude the wealthy oil-producing countries), in most cases per capita income has fallen sharply over the past twenty years. In Africa, this decline has nearly always been accompanied by a reduction in food supplies. These very poor countries usually have only a veneer of industrialization and an agriculture based on a single crop which is incapable of producing a surplus. Their health systems are inevitably restricted by the **scarcity economy.** Lack of foreign currency precludes the purchase of the medicines and equipment needed to prevent and cure costly diseases.

The "poor health achievers" are countries where adult women are practically excluded from education. Only half as many women as men are educated in Zaire and in Mozambique, one-sixth as many in Afghanistan and Nepal and one-eighteenth as many in Yemen: this goes some way towards explaining the difficulty of reducing infant mortality rates. It is not surprising that, in the same countries, very high fertility rates persist and the birth rate has scarcely changed.

Insofar as high infant mortality rates and the prevalence of infectious diseases can be traced back beyond health systems, poor achievements on the health front cannot be dissociated from poor economic achievement. All too often, primary health care networks mask an inefficient bureaucracy, and the bulk of a country's resources is absorbed by hospitals to the detriment of rural dispensaries. And it is impossible to overlook excessive arms spending, debt servicing, shaky economic policies and the misuse of internal and external resources. In an age of famine and permanent warfare, authoritarian political and military systems can hardly be expected to eradicate poverty, hunger, ignorance and disease.

The most precarious states of health in traditional agrarian societies are often coupled with the absence of modern medicine. There are no medical supplies, doctors or hospitals. These health care vacuums still prevail in vast underpopulated areas, notably in Africa. However, it is important not to underestimate the consequences of the **population shift** away from the countryside, which has sent two-thirds of the population pouring into the towns in the countries

around the Mediterranean, in Latin America and in Eastern Asia. Uprooted families disintegrate in the shanty towns. The causes of the unduly high death and disease rates that the West is discovering in new forms of urban poverty (see the *Unesco Courier*, January 1987) inevitably exist in more acute form in the developing world. But social groups living in precarious conditions, whether or not they receive assistance from the authorities, are improvident and do not of their own accord adopt the preventive behaviour patterns which are the most effective weapon in the war on alcoholism, drug abuse and sexually transmitted diseases.

Some countries, following a long economic decline, are experiencing a gradual erosion of their former health achievements. In Argentina, for example, the density of medical coverage today is still twice that of the Republic of Korea; there are more hospital beds and life expectancy is higher. But the infant mortality rate is lower in the Republic of Korea, and even in Chile and Costa Rica, than it is in Argentina. And yet in 1950 the health indicators for Argentina were better than those for France, while male life expectancy in Korea was comparable to that of Bangladesh today.

New causes of mortality

As infectious diseases and infant mortality take a diminishing toll, gains in life expectancy must be obtained by overcoming the risks that threaten adolescents and adults. The increase in life expectancy and the change in the age composition of the population bring new priorities for health policy.

Falling death rates are due primarily to the decrease in infectious diseases. Attempts to tackle the causes of infant and juvenile mortality produce appreciable gains in life expectancy for a relatively small investment. But once infant mortality has been lowered by health and nutrition education and by the distribution of vaccines and antibiotics, health action becomes less efficient. Gains against mortality now have to be won in a high risk area.

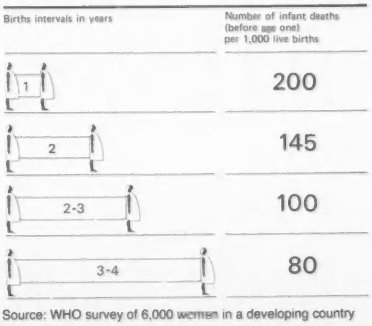
The primary causes of rising death rates are **road accidents** and **violence.** As in the old European countries and in North America, accidental death has become the main contributor to mortality figures for young people in the developing world. The cost in human lives of the increase in road traffic in the cities of developing countries is seldom appreciated. There are many serious accidents, and emergency treatment and aftercare facilities are limited. For a young adult in São Paulo, the probability of dying in a road accident increased tenfold between 1940 and 1980. The same is true of homicide. Dependence on alcohol and drugs can increase these risks.

The second trend in mortality rates is due to the rise of **chronic degenerative diseases.** Today, countries such as Brazil have a small proportion of elderly people but in the next generation there will be a rapid increase in the number of over-sixties. Already, cardiovascular diseases and cancer have become the main causes of mortality. Con-

Photo WHO

In co-operation with the World Health Organization (WHO), Unesco encourages the use of the media in health and nutrition education.

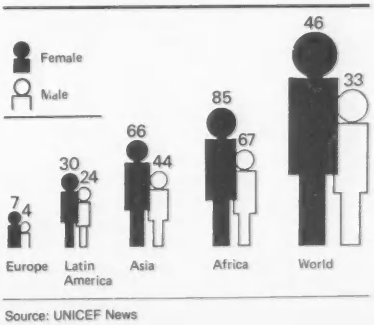
Spacing births reduces death



Source: WHO survey of 6,000 women in a developing country

Illiteracy

Nearly two out of every three illiterate people are women. Yet an educated woman not only enjoys better health herself—she has a positive influence on the health and well-being of her entire family.



Source: UNICEF News

Photo © Urs F. Kluyver, Hamburg, Fed. Rep. of Germany

"As in the old European countries and in North America, accidental death has become the main contributor to mortality figures for young people in the developing world. ... There are many serious accidents, and emergency treatment and after-care facilities are limited."

sequently, the future increase in life expectancy will depend on the resources allocated to treat these costly diseases. When the human life-span attains and exceeds seventy years, the survival of cardiac patients, cancer sufferers, diabetics or kidney patients cannot be guaranteed without medicines, specialized services and qualified doctors.

The crisis in health systems in the West should be a warning to authorities in other world regions. The Japanese, for example, by mobilizing only half the resources deployed by the North Americans, have achieved the world's highest life expectancy and lowest death rate.

Health systems, like political systems, tend by a process of imitation to reproduce existing health models. Following the dominant trend, developing countries have transposed Soviet, Chinese, North American or European systems, but these have seldom proved appropriate to local conditions. The results are often less encouraging than they were for the original model.

Recourse to medical solutions is often premature. It is preferable to do everything possible to preserve family and community structures which can provide routine care. In this way, the very high cost of hospitalization of the mentally ill, children, expectant mothers, the elderly and invalids can be to some extent deferred.

Lastly, "hospitalocentrism" is the most common pitfall for Western systems transposed to other countries. The cost of a hospital is always underestimated. It tends to become the pivot of the system and to suck in all its resources. Today, public health budgets are frozen, and resources for primary health care networks in the form of manpower and funds have been reduced.

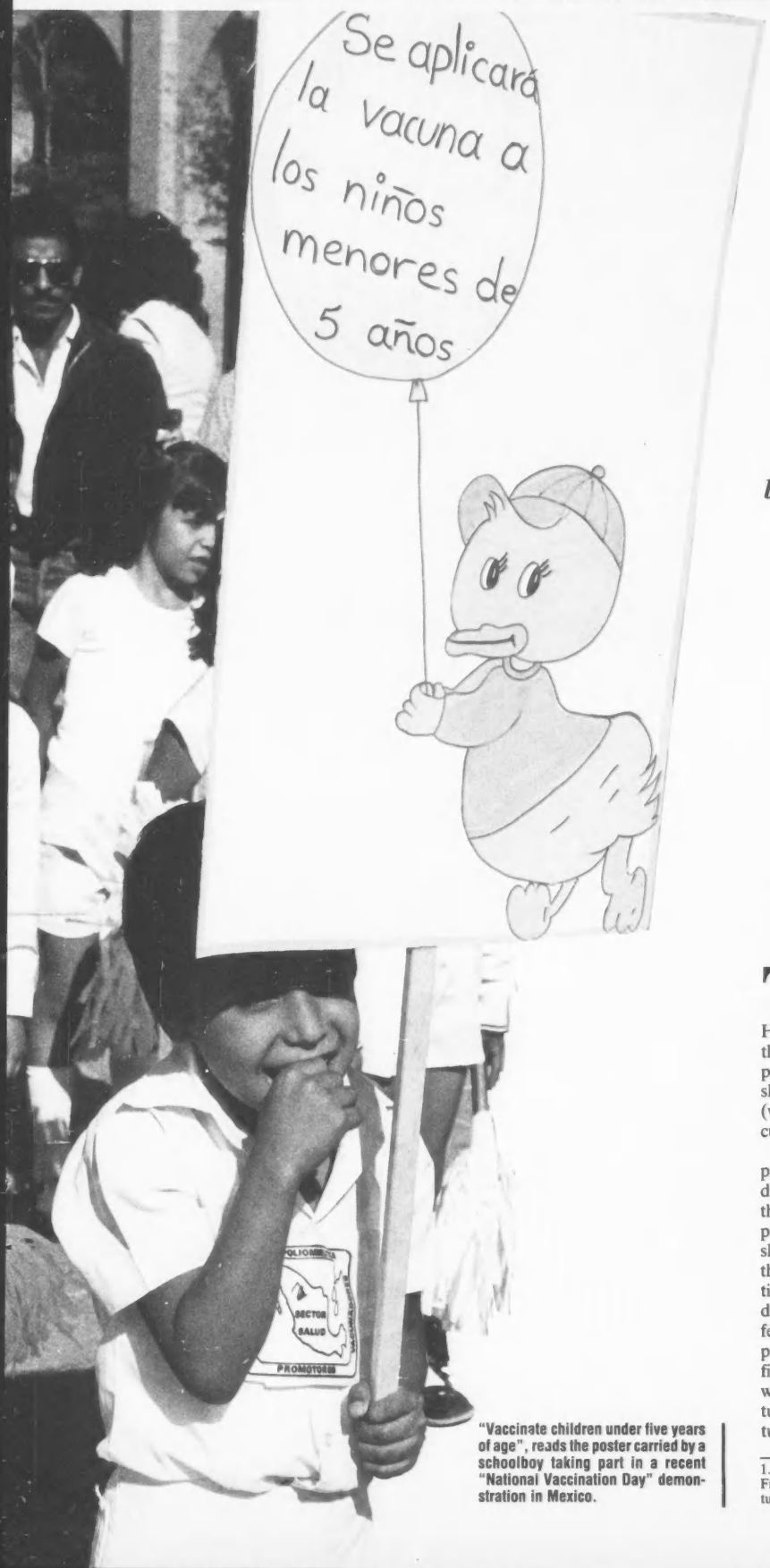
In conclusion, it seems that an improvement in general health is within the reach of the poorest countries, and more particularly the semi-industrialized developing countries. However, these are transitional improvements. In order to overcome new causes of morbidity and mortality, these countries must in future devote more money to their health systems. As they often have to cope with a difficult international climate and continue their economic development efforts at the same time, a variety of ways of financing health care seems the best approach. It is noteworthy that the most spectacular successes in this respect, in the industrialized countries of Eastern Asia, are due to a judicious combination of public expenditure and private financing. ■

Photo P. Almasy/WHO

Makeshift shower-bath in a crowded city street in South-East Asia. Attitudes to hygiene have a direct bearing on health. Studies on living conditions and health in urban areas have been carried out as part of Unesco's Programme on Man and the Biosphere (MAB). A major MAB study on Hong Kong revealed the importance of such factors as cultural background and family structure in contributing to well-being and good health.

DENIS-CLAIR LAMBERT, *of France, is professor of political economy at the University of Lyon III and president of the Medical Economics Society of Lyon. Among his published works are* 19 amériques latines: du déclin au décollage *(1984; "19 Latin Americas: From Decline to Takeoff") and* Lexique d'économie de la santé *(1985; "Dictionary of Health Economics"). This article has been extracted from an address given at a symposium on the theme "Health, Medicine and Development", organized by the Fondation Liberté Sans Frontières in Paris, February 1987.*

Photo WHO



"Vaccinate children under five years of age", reads the poster carried by a schoolboy taking part in a recent "National Vaccination Day" demonstration in Mexico.

A chance for every child

by Michel Rey

THE goal of the Expanded Programme on Immunization (EPI), launched by the World Health Organization in 1974, is to ensure that by 1990 all the world's children are protected against six killer diseases: measles, poliomyelitis, diphtheria, pertussis (whooping cough), tetanus and tuberculosis.

These six target diseases have been given priority because each year they cause hundreds of thousands of deaths and tens of thousands of disabilities. Now they can be prevented by immunization. In theory measles and polio are eradicable, and diphtheria and whooping cough can be practically eliminated. For the other two diseases, the aims of EPI are rather different. The Programme gives priority to the prevention of neonatal tetanus; and confines itself to tuberculosis in children, of which the most serious manifestation is tuberculous meningitis. The BCG anti-tuberculosis vaccine[1] only protects children

1. BCG (bacillus Calmette-Guérin): named after the French scientists who produced the first attenuated tuberculosis vaccine in 1906.

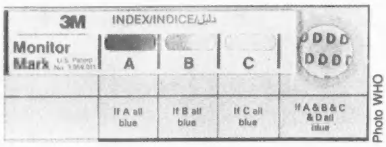


Photo WHO

Blue for danger

A key factor in the implementation of WHO's Expanded Programme on Immunization, which aims at protecting all children against measles, polio, diphtheria, whooping cough, tetanus and tuberculosis by 1990, is called the "cold chain" system. The cold chain ensures that vaccines retain their potency from the time of manufacture to their use. Although there may be no visible signs of deterioration, vaccines lose potency when exposed to heat. To show whether or not the cold chain has been broken, a special temperature sensitive chemical monitor has been designed (above), to be attached to record cards in the national language of the destination country. The monitor has four windows, A to D, and when placed in cold boxes or refrigerators with the vaccines, it turns blue window by window as the temperature rises.

against contamination and cannot change the epidemiology of the disease, which is carried and transmitted mainly through adults.

EPI is implemented in two ways. The main thrust is the immunization of children under a year old, who are given the six vaccines over at least three sessions. The second line of attack, against neonatal tetanus, is aimed at pregnant women and other women of childbearing age. Here, immunization before birth protects the child.

The aims of the Programme are ambitious. For the moment the chief objective is to give all the world's children access to immunization services. It is accepted that between now and 1990 it will be difficult to achieve the 90 per cent level of immunization coverage initially projected for the group of six vaccines. A 70 to 80 per cent coverage rate would be satisfactory. For neonatal tetanus, a more precise objective has been defined for 1990: reduction of its incidence to less than one case per thousand live births in countries which are still relatively widely affected and to eradicate the disease entirely in those countries where it has become a rarity.

EPI can be distinguished from other preventive medicine campaigns by the significant technological and operational constraints it faces, and by the fact that this form of prevention is basically managed by health services, the resources of which are mobilized at all levels.

The first constraint concerns the supply of vaccine. Vaccines are increasingly complex biological products, manufactured using advanced technology, and they are still largely made by industrialized countries. There are many obstacles to local production. Even India, a relatively well equipped country with a vast internal market, has not yet succeeding in producing all the vaccines it needs for domestic consumption. The use of low-quality, cheaply produced vaccines is unacceptable. Such vaccines are often less efficient, and are also less well tolerated. They will jeopardize the success of the Programme by discouraging people from taking part in it. Much of the vaccine used by EPI is supplied by international organizations or aid agencies and must conform with WHO standards.

The preservation of vaccines necessitates the maintenance of an uninterrupted "cold chain". In many cases, the absence or breakdown of this chain has meant the failure of immunization, especially using heat-sensitive live vaccine such as the measles or the oral polio vaccines. A less temperature-sensitive measles vaccine has recently been developed, but the cold chain is still necessary.

Finally, most vaccines are administered by injection and syringes and needles have to be very carefully sterilized. It is possible for tetanus to be transmitted by the injection, and today the risks of transmitting hepatitis B and AIDS by syringes must be stressed.

How can maximum numbers of the target populations be reached? Priority has been given to the integration of immunization into primary health care. Even if village health workers cannot give injections or keep records, they can play a significant role in informing and mobilizing the population. Obviously this grass-roots participation does not exclude action by other branches of the health services.

If health centres generally bear the main responsibility for routine immunization, the lack of such centres in many rural areas creates the need for small mobile teams to immunize the people in or near their homes. Mothers cannot be expected to walk more than three kilometres from their homes in order to have their children immunized. It is admirable enough that they are willing to make even this effort towards preventive care. One major problem of immunization campaigns is opening individual files on all children from birth onwards, so as to record the injections they are given, maintain personal contact with their families and keep track of the negligent.

When immunization by health centres is not feasible, or when the results are unsatisfactory, mass campaigns can be launched, on a local or national scale. This has been done in Brazil, with the oral polio vaccine, and in Colombia with the six EPI vaccines. The advantage of such campaigns, which can assume the guise of a national festival, is that they mobilize more of the population and enable large numbers of people to be immunized, at least at first. Their epidemiological effect is more spectacular and for a time they can interrupt the transmission of certain diseases. But they are only a means of getting the Programme under way.

What are the achievements of EPI to date? The evaluation of immunization coverage, often effected by poll, shows great differences between countries (from less than 10 per cent to over 80 per cent). This wide range reflects different levels of social and economic development and clearly shows that it is easier to achieve a rapid increase in immunization coverage where there are well-developed health infrastructures.

One of the biggest problems is the fall in family participation between the first and last immunization session, a rate which can be as high as 50 per cent. The older the child, the lower the rate of participation. The BCG vaccine, which is given earliest, has been the most successful from this point of view. It should not be forgotten that in the United States it took twenty years to achieve a 95 per cent coverage of measles immunization, the level at which eradication of the disease can be envisaged.

Efforts are thus being made, in the case of measles, for example, to immunize nearer birth. This shortening of the immunization timetable is also a response to the need to immunize children as soon as possible after birth, before they are exposed to natural infection.

Another vital factor in the success of the Programme is continuous health education, which, if it is to be effective, must take into account the way in which disease is perceived in different cultures (see article page 4). Moreover, as the Programme continues and the incidence of the target diseases falls, the people start to be less afraid of them and lose interest. This is where

The slogan chosen for World Health Day (7 April) 1987 was "Immunization: a chance for every child". Below, stamps issued by the United Nations Postal Administration to highlight efforts by WHO and UNICEF to save children from preventable diseases.

Photos United Nations

Photo WHO/J. Mohr

In the rural areas of many developing countries, mobile teams of health workers are needed to immunize villagers in or near their homes. Above, nurses in the Philippines set off on their rounds.

education can be effective. Finally, the major role played by women in the success of the Programme cannot be over-emphasized. It is they who have their children immunized, it is they who must be informed and won over.

The true effectiveness of EPI is measured in terms of morbidity[2] and mortality.[3] These factors are the most difficult to evaluate at present due to the lack of reliable epidemiological monitoring. Three indices are studied: the incidence of paralytic poliomyelitis, death from measles and death from neonatal tetanus. The regression of these diseases is notable in most Latin American countries, and the incidence of neonatal tetanus has fallen dramatically in Bangladesh. The results for measles have on the whole been rather disappointing, and can be explained by inadequate immunization coverage, by the impossibility of administering the measles vaccine to children under six months, and by the difficulty of preserving the vaccine, which until recently was very susceptible to heat.

As a result of all the technological and operational constraints it faces, EPI is relatively expensive. A full course of immunization for a child costs from $3 to $50 (the present average being $10). The cost of the vaccine itself hardly represents 10 per cent of this sum, most of the remainder being used to cover staff or operational costs. Many poor countries cannot afford such expenditure and receive outside aid. The disadvantage of this is that a situation of dependence is created.

EPI is nevertheless considered to be one of the most profitable operations in preventive medicine. Its "profitability" is measured in human terms (in the sparing of lives, and in the reduction of suffering and of disabling after-effects), rather than in strictly economic terms.

Finally, in addition to the direct advantages of immunization (reduction of morbidity and mortality from the six target diseases) a number of perhaps even more important indirect advantages can probably be added, such as improving the child's nutritional state, which is greatly affected by whooping cough and measles. Another expected advantage is the strengthening of health services at all levels. EPI is thus acting as a pacemaker in health care development. ■

Logo of WHO's Expanded Programme on Immunization.

Photo WHO

2. Morbidity: the relative incidence of a particular disease in a specific locality.
3. Mortality (death rate): the ratio of deaths in a specified area or group to the population of that area or group. *Editor.*

MICHEL REY, *of France, is director of the Epidemiology and Management section of WHO's Division of Communicable Diseases and professor of infectious and tropical pathology at the Faculty of Medicine, Clermont-Ferrand, France. He is the author of* Vaccinations *(1980). The above article is an edited version of his contribution to a collection of essays on health, medicine and development published in 1987 by the Fondation Liberté Sans Frontières, France.*

Complementary medicine

by Stephen Fulder

COMPLEMENTARY medicine, also called natural, alternative, traditional or unconventional medicine, encompasses a variety of therapeutic systems which are linked by the fact that they are different from conventional medicine. The central therapies are acupuncture, chiropractic, healing, herbalism, homeopathy, hypnotherapy, therapeutic massage, naturopathy and osteopathy. Other systems may be developed in theory and practice but are not so well known in Western countries, such as anthroposophical[1] or Ayurvedic medicine.

In all these cases there is a diagnostic procedure, a theory to account for the origin, development and cure of sickness, an established body of practical knowledge, and a professional grouping of practitioners. The theory and practice may be far removed from that of conventional medicine—for example acupuncture is partly based on concepts of circulating vital energy, and of *ying/yang*. Nevertheless these therapies can exist in partnership with, rather than competition with, conventional medicine. Therefore we prefer the term "complementary" rather than "alternative", "natural" or "unconventional" medicine.

Despite their diversity, theories of complementary medicine are united by certain common features. One important common element is that they encourage and elicit self-healing. Homeopathy uses minute doses of plants that mimic the symptoms of the disease, while herbalism utilizes large doses of other plants to undermine the symptoms. Yet both homeopathic and herbal remedies are given specifically to stimulate natural recuperative processes.

Symptoms do not have the same meaning in complementary medicine as they do in conventional medicine. They are not considered as untoward signs that must be attacked when they appear, but as guides to underlying imbalances, vulnerabilities and idiosyncrasies, and as monitors of progress towards health. To take one example, a traditional acupuncturist will examine, with considerable sensitivity, the skin colour, voice, tongue, eyes, pains and the flow characteristics of blood within several pulses. From these data he reads the interior organ dysfunctions of the patient. As he strives to correct these dysfunctions, he watches how the signs and symptoms change as a result of the treatment to make sure he is on the right track.

The patient is treated as an individual. There is little interest in statistical or population norms; instead the individual is his or her own point of reference. A weak pulse may, for example, be quite normal in one constitutional type and a sign of sickness in another. Health is defined as the optimal function and longevity of the individual. In addition, since the whole person, rather than the disease, is the focus of treatment, there is no practical or philosophical reason to erect barriers such as that between mind and body. Lifestyle, cast of mind, mood, energy, posture or constitution are all as relevant diagnostically as the physical signs.

Complementary medicine today is the descendant of traditional and folk medicine: herbalism descends from shamanism and folk remedies, chiropractic and osteopathy from bone setting, homeopathy from like-cures-like principles, naturopathy from the Hippocratic tradition.

Curiously, scientific medicine traces its origins to those same roots, via Galen of Pergamum in the 2nd century AD. However, it has diverged over the last 150 years towards a complete, perhaps exaggerated expression of specificity principles. That is, ill-health consists of a specific set of symptoms, defined as a specific disease, which is cured by the precise treatment for that condition. This is in marked contrast to the Hippocratism of complementary and traditional medicine which regards ill-health as a vulnerability derived from imbalances within the individual. Complete cure is only possible by restoring the equilibrium—*crasis*—with the help of self-healing capacities—the *vix medicatrix naturae*.

The specificity approach achieved complete dominance during the last century, after a bitter struggle. The traditionalists called the new practitioners quacks, and modern medicine replied by ridiculing the traditionalists' arcane doctrines and witches' brews. The outcome was sealed with the help of new drugs extracted, ironically, from the plants of the herbalists. The spectacular results of aspirin, digitalis, quinine and opium left the traditionalists with their principles but no patients. The traditional systems were effectively outlawed all over the modern world. A resurgence of interest only began in the 1960s, mainly through the realization that modern medicine bears a heavy cost in resources and side effects. In addition it became clear that many chronic conditions that are related to lifestyle, such as back pain or atherosclerosis, could yield to complementary medicine's gentler, more integrated, approach.

CONTINUED ON PAGE 19

1. *Anthroposophy* : philosophy based on the premise that the human intellect has the capacity to contact spiritual worlds. *Editor.*

Moxa, or moxibustion, is a traditional Chinese therapy in which small cones of dried plant material are burned on specific points of the body (generally the same as those used in acupuncture). The term "moxa" is derived from the name of the wormwood plant most frequently used, *Artemisia moxa*. Right, a Tibetan doctor applies a variant of moxa treatment in which the heat is transmitted to the patient's skin by a needle. The circle of card is used to collect the ashes.

Photo Gérard Sioen © CEDRI, Paris

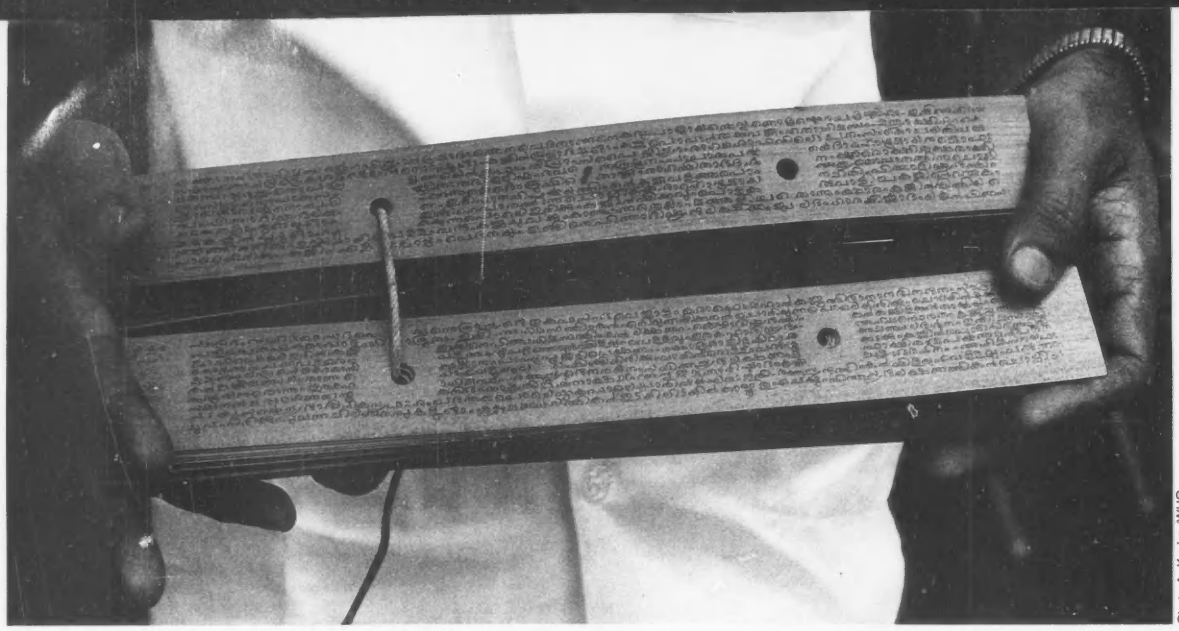


Photo A. Kochar/WHO

Over 3,000 years old, *Ayurveda* ("knowledge of long life") is a Hindu medical system which relies largely on plant medication. The ancient Ayurvedic medical shastras (manuals) written or engraved on palm leaves and pieces of bamboo wood, above, have been handed down from generation to generation. This form of traditional medicine is widespread in India where there are some 400,000 practitioners and over 200 Ayurvedic hospitals.

Photo J.O. Mume/WHO

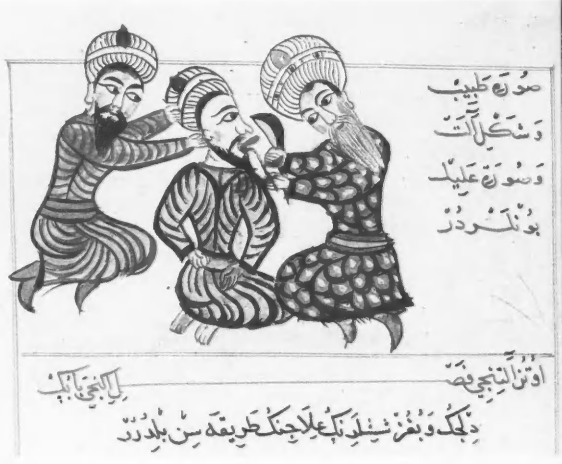


Photo © Bibliothèque Nationale, Paris

The removal of a ranula, a cystic tumour beneath the tongue, is depicted in this illustration from a Turkish surgical manuscript by Sharaf ed-Din (1465).

Left, two Nigerian women who are recognized in their community as traditional healers. The woman on the right specializes in problems related to childbirth.

CONTINUED FROM PAGE 16

Why do people go to complementary practitioners? For ideological reasons? Because of advertising? Or only as a result of disappointments elsewhere? A survey conducted in the Netherlands in 1980 found that 40 per cent of the patients of complementary practitioners sought them as a result of prior inadequate or unsuccessful treatment of the same ailment by doctors. This was confirmed by a government-sponsored study in Australia which showed that necessity, not belief, brought people to unorthodox clinics.

Furthermore, complementary medicine does not fill gaps left by modern medicine. Several studies have indicated the opposite, that complementary medicine flourishes in areas that are especially well served medically. This supports the notion that it provides another alternative in cases where conventional medicine has failed. The patients, too, tend to be slightly more educated and slightly better off than the national average.

If that is the case, the kind of health problems that arrive at the door of the complementary practitioner might be expected to be the failures of conventional medicine, an indication of the potential partnership between the conventional and complementary systems. The failure areas of conventional medicine are well known. They are usually chronic conditions, often musculoskeletal problems connected to lifestyle, such as back pain and arthritis, chronic pain such as migraine or neuralgia, chronic infections such as bronchitis, ulceritive colitis, urethritis, allergic conditions, fatigue, insomnia and debility, cardiovascular problems and stress-related disorders. These conditions are generally managed rather than cured, as in the administration of cortisone for allergies and painkillers for back pain.

Evaluative studies on complementary medicine have shown that it is at least as successful as conventional medicine in the short-term treatment of conditions it commonly treats. The few studies on the long-term management of such conditions usually put complementary medicine on top. Many studies show, for example, that acupuncture or hypnosis are as effective as painkillers in pain relief and can be more effective in the long term. A much-discussed trial conducted in 1980 at the Glasgow Royal Infirmary (U.K.) reported that homeopathy is as successful as conventional drugs in the treatment of rheumatoid arthritis.

At the same time, polls of patients have reported remarkable satisfaction with complementary medicine. The Netherlands, Australian and other studies report that more than 80 per cent of patients would recommend complementary treatment to others. Those who were not happy with their complementary practitioner were found to be uncured but unharmed, while those dissatisfied with their doctor were uncured but not necessarily unharmed.

An incidental boon has been gained from research into complementary medicine: new sources of ideas and principles have emerged. Study of analgesia by acupuncture, for example, has brought a new understanding of the mechanisms of pain control. A number of new drug entities are being introduced as a result of research into traditional folk remedies. Indeed it has been calculated that if traditional practitioners are consulted, as opposed to random screening, the rate of discovery of pharmacologically-active ingredients is increased from much less than 1 per cent to 40 per cent.

The development of complementary medicine poses questions to government authorities and the entire medical establishment. How can traditional acupuncture be incorporated into a medical insurance scheme? How can laymen practise alongside medical professionals? How can the different medical specialities communicate with one another when their language, concepts and practices are so widely different? It is quite clear that if complementary medicine is to be absorbed into the mainstream of medical care some fundamental reappraisals will be necessary. If it is not to be so absorbed, complementary medicine will simply continue to receive more patients from the mainstream.

The major requirement is for education. If trainee doctors could learn in medical schools what complementary medicine is, and what it can do, they would learn how to co-operate with its practitioners, as in China and indeed in the USSR where a restricted form of acupuncture teaching is available in medical schools. At the same time practitioners of complementary medicine should be helped to improve their biomedical knowledge, an area of acknowledged weakness today.

The wise employment of complementary medicine would save much unnecessary use of medical resources and hospital beds. The preventive approach could be used to catch conditions before expensive and dangerous medical intervention was needed. If hypertension and arteriosclerosis were treated by diet, herbs and techniques of relaxation, coronary intensive care units and the heart surgeons might be put out of business.

A more preventive attitude would be required throughout the medical establishment. Medical care would shift away from technology-intensive centres into the community. Treatment would be more personal as long-term therapeutic relationships would be built up between patient and therapist. Medical insurance would be required to broaden its definitions of treatment and take a longer-term view. Even the hospitals would change their character. Besides providing last-resort care, which will always be necessary, they could become teaching centres. As well as teaching doctors, as they do now, there is no reason why they could not teach patients too. ■

STEPHEN FULDER, *of the United Kingdom, is a biochemist and specialist in cellular ageing. A former teacher at Chelsea College, London University, he is the author of many articles and books, including* The Handbook of Complementary Medicine *(1985). A longer version of this article has appeared in Unesco's international quarterly* Impact of Science on Society *(No. 143, 1986).*

Photo James P. Blair © National Geographic Society, Washington, D.C.

Shavings from the *Garcinia punctata* tree, above, are used in a traditional prescription for diarrhoea among certain Zairean peoples which possess a profound knowledge of the medicinal plants of the tropical forest.

Photo © All Rights Reserved

The Barbary fig *(Opuntia ficus-indica)*, above, is a cactus which originated in tropical America and now grows widely in the Mediterranean Basin. Its fruit is edible and the plant can be used medicinally. Photo is taken from a book on the medicinal plants of the Aeolian Islands, prepared for publication in Italy later this year with support from Unesco's Man and the Biosphere (MAB) Programme.

Photo © Bibliothèque Nationale, Paris

Plant therapy in the fight against cancer

by Xing Sishao

IN China, many practitioners of traditional medicine are making a unique contribution to the fight against cancer by combining their clinical experience with the heritage of ancient Chinese medicine. One of them is Professor Duan Fengwu, Chief of the Tumour Department of the Beijing Guang'anmen Hospital, which is affiliated to the China Academy of Traditional Chinese Medicine.

Professor Duan has treated about 10,000 cancer sufferers since his hospital opened its Tumour Department in 1962. In China, on average only 29 per cent of patients with stomach cancer survive for as long as five years after treatment with Western medicine, yet the figure stands at 55.23 per cent in the cases that he has treated.

According to Professor Duan, treatment of cancer with traditional Chinese medicines can be traced back as far as the Yin Dynasty (12th century BC). *Ai*, the current Chinese name for cancers, appeared for the first time in two medical works published in the Sung Dynasty (960-1279), the *Weiji Treasure Book* and the *Ren House Directory of Medicine*. The latter includes this description: "*Ai* rises beneath the skin and reaches deep in the flesh. When dissected, it looks like the inside of a karst grotto; small lumps, some blue, protrude like outward-thrusting eyeballs and each has a tip sticking out. Their poisonous roots are buried deep in the body." As a description of malignant tumours it is very similar to that of modern Western medicine.

According to Professor Duan, 200 kinds of traditional Chinese drugs and medicinal herbs can be used to treat cancer, about 80 of which are the most commonly used. "We have studied some of them in particular," he says, "and most are effective in checking the growth of tumours, alleviating clinical symptoms and stimulating the immune reaction within the human body, thus extending the life of the patients.

"Traditional Chinese medicine holds that though cancer afflicts only a certain part of the body, it is a disease affecting the whole body. In treating cancer, therefore, the condition of the entire body should be taken into consideration and special attention should be paid to internal factors when analysing the cause of the disease. The relationship between strengthening the patient's constitution and dispelling the invading pathogenic factors should be handled properly."

In his long career of treating cancer patients, Professor Duan attaches great importance to the harmony of *yin* and *yang*[1] in regulating *xue* (blood) and *qi* (vital energy). By using traditional drugs and herbs, he seeks a restoration of balance between *yin* and *yang* in a patient. After his treatment, many patients have recovered and a number of serious cases have even lived on for more than ten years.

Professor Duan says that ginseng, for example, functions mainly as a tonic for the vital energy of the body; it can stop prostration and replenish the body fluid and it has been effective in dealing with malfunction of body organs due to deficiency of vital energy.

"However", he added, "ginseng is not omnipotent. It must not be abused, otherwise it harms rather than benefits the health. Two kinds of extracts from ginseng have been seen to activate the immune reaction in the human body. They can enhance phagocytosis[2] and stimulate the growth of antibodies. Some doctors think that these ginseng extracts can directly destroy cancer cells or reverse their development."

Professor Duan believes that traditional Chinese medicine, radiotherapy and chemotherapy all have advantages and disadvantages in the fight against cancers. Radiotherapy and chemotherapy have been very effective in treating some malignant tumours by killing the cancer cells or by stunting their growth, but their biggest drawback is the indiscrimination with which they destroy cells. Some patients die of the complications caused by such treatment instead of the cancer itself. The advantage of traditional Chinese drugs and medicinal herbs, on the other hand, is that they have few adverse side-effects. They can strengthen the patients' resistance and immunity and summon the "vital energy" of the whole body to battle against the disease.

As Professor Duan says: "We should supplement traditional Chinese medicine with modern Western medicine. It seems to me that a combination of these methods may prove to be the best way to fight cancer. We are all looking forward to the day when mankind can conquer this fatal disease." ■

Above, pharmacists weigh medicinal herbs at Beijing's Tong Ren Tang drugstore, which has specialized in traditional Chinese medicine for over 300 years.

1. *Yin* and *yang:* the two fundamental principles or forces in the universe, ever opposing and complementing each other—an ancient philosophical concept used in traditional Chinese medicine to refer to various antitheses in anatomy, physiology, pathology, diagnosis and treatment, e.g. feminine, interior, cold and hypofunction being *yin*, while masculine, exterior, heat and hyperfunction are *yang*.
2. Phagocytosis: the process by which living cells (phagocytes) ingest or engulf other cells, bacteria or viruses, as a defensive reaction against infection. *Editor.*

XING SISHAO, *of China, is head of the traditional Chinese medicine section and associate senior editor of a Chinese journal on health. He is the author of several books, including "Famous Contemporary Doctors".*

A fraction of the pharmaceutical products on the market would be enough to satisfy human needs

Overdose

by Georges Peters

The vast range of pharmaceutical products on sale in many developed and developing countries is not medically justified and helps to encourage an excessive demand for drugs which drains the resources of health services.

APPROXIMATELY 90 per cent of all drugs produced for human use are manufactured and delivered in ready-to-use form by the pharmaceutical industries. Only in exceptional cases are drugs concocted by pharmacists or healers. The developing countries, inhabited by 80 per cent of the world's population, consume from 15 to 20 per cent of the world's pharmaceutical output. Drug consumption is tending to rise more rapidly in these countries than in wealthy countries.

On the other hand, the developing world produces only 10 per cent of all drugs consumed, and production is confined to a few countries such as Argentina, Brazil, Egypt, India, Mexico and Pakistan. The other developing countries are obliged to buy all their drugs from the rich countries and to spend a substantial portion of their health budget, or even of their national budget, on such purchases. Even so, many of them are still unable to satisfy the most pressing needs of the majority of their population.

It is thus clear why developing countries and international organizations should take an interest in pharmaceutical industries.

These industries developed in the late

Photo © Zhang Jinjie, Beijing

Photo Matuy © Gamma, Paris

nineteenth century, usually as divisions of chemical-manufacturing firms which were dissatisfied with their position as suppliers of cheap ingredients for medicines which were then sold at high prices by the pharmacists. In a bid for some of the profits, they launched specialized pharmaceutical products under protected brand names. The link between the manufacture of pharmaceuticals and the chemical industry is so important economically that nearly all the drug-manufacturing industries belong to chemical-industrial complexes. Only these chemical-pharmaceutical trusts manufacture drugs from non-medicinal raw materials, and they alone are in a position to develop new drugs.

Pharmaceutical innovation calls for clinical and biological research on which the big manufacturers (which present themselves as members of a pharmaceutical industry based on research) spend an average 9 per cent of their turnover, approximately 4.5 per cent of the final resale price of their products. This is less than half the amount they spend on advertising. Most of the 120 companies which dominate 90 per cent of the world pharmaceutical market and the 25 multinational corporations which produce 60 per cent of all pharmaceutical products, belong to this industry. Their average annual turnover amounts to $750 million.

The manufacture of pharmaceuticals calls for substantial capital investment. Because of the automation of manufacturing processes, the industry creates very few jobs. Pharmaceutical companies differ from other businesses primarily in that they manufacture a product which consumers do not usually choose themselves but which is recommended to them directly or indirectly by a doctor. Moreover, the demand for and sales of drugs far outstrip needs.

The world market of $200,000 million a year corresponds to $50 per person per annum spent on medicines. Less than a quarter of this amount should suffice to satisfy all medically justifiable needs. The remainder is spent in an attempt to treat symptoms or illnesses which will not respond to this form of treatment, or to improve vigour and general health (something that no drug will do), or to satisfy a craving for certain drugs which has been created by their use in the past. Overconsumption of drugs is particularly widespread in the affluent countries, where per capita spending can be as high as $160 per annum (as it is in Switzerland and France).

All human beings have the same basic needs with regard to curing or treating an ailment, relieving a symptom or acquiring protection against a disease. However, the drug needs of populations in different regions of the world can vary, depending on the incidence of the prevailing diseases. In developing countries, for example, more than 30 per cent of deaths are due to infectious bacterial and viral diseases and to parasitic diseases (which cause 4 per cent of deaths in the wealthy countries) and could be avoided by curative drugs. In the rich countries, more than 60 per cent of deaths are due to circulatory, respiratory and neurological diseases and to malignant tumours (which cause fewer than 30 per cent of deaths in the developing world): these patients need symptomatic treatment and can in some cases be maintained in a satisfactory condition by palliatives.

The number of drugs needed to satisfy all human needs is very small. The Expert Committees of the World Health Organization (WHO), which since 1977 have drawn up and revised the *Model List of Essential Drugs*,[1] have had the task of selecting drugs which are necessary and sufficient to treat 95 per cent of all diseases and of all human symptoms susceptible to treatment by drugs. The 1985 edition of the *Model List* names 379 products containing 262 active substances (in varying forms: tablets, drops, capsules, etc.). If the aim were to satisfy 99 per cent instead of 95 per cent of all needs, the figure would probably rise to 350 substances in 500 commercial forms. Yet the number of drugs on sale in the highly developed countries nearly everywhere exceeds 15,000, containing between 700 and 1,100 active substances.

The difference between the number of drugs and the number of active substances is so great because most of the former are simply different forms or fresh combina-

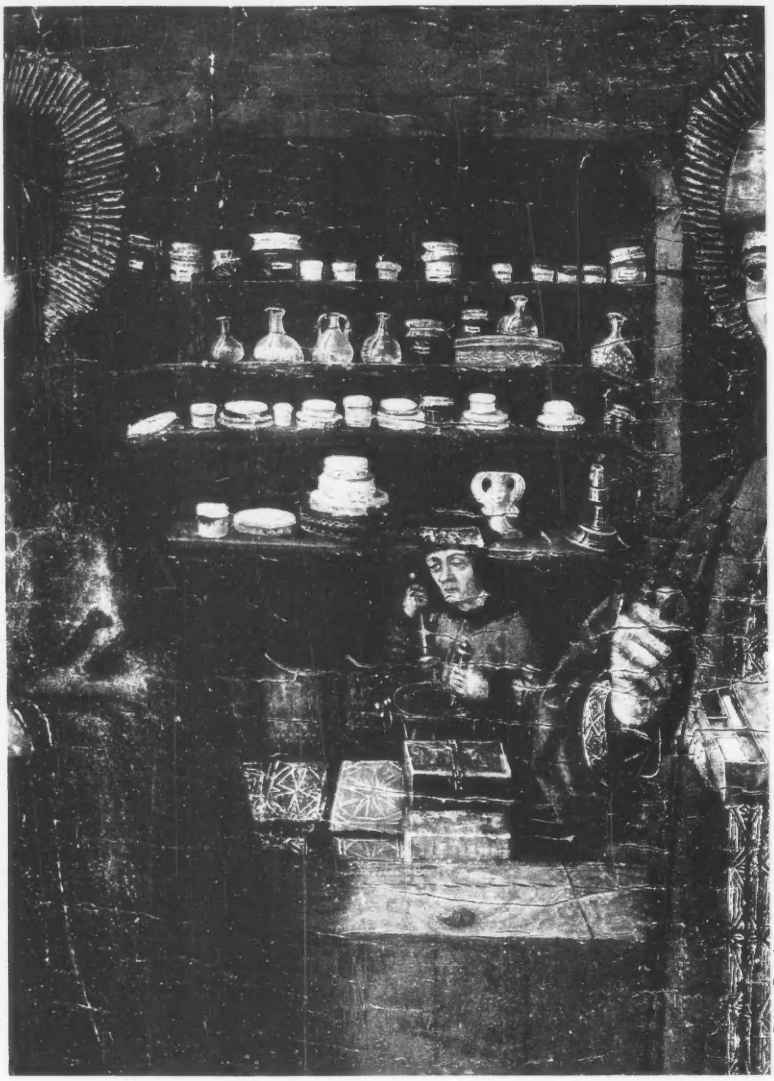


Photo © Mas, Barcelona

Western doctors once prepared their own drugs and then obtained them from apothecaries, the ancestors of today's pharmacists. Above, detail from a 16th-century painting shows an apothecary framed by the brothers St. Cosmas and St. Damian, Christian doctors of Arab origin who were martyred around 295 during the reign of the Roman emperor Diocletian. The modern pharmaceutical industry began to develop early this century, with the production of the first synthetic drugs. Above right, preparation of vaccine against poliomyelitis, the major cause of disability in developing countries, at the Mérieux Institute, a French pharmaceutical laboratory.

1. The Expert Committee has defined the word *drug* as "any substance in a pharmaceutical product that is used to modify or explore physiological systems or pathological states for the benefit of the recipient".

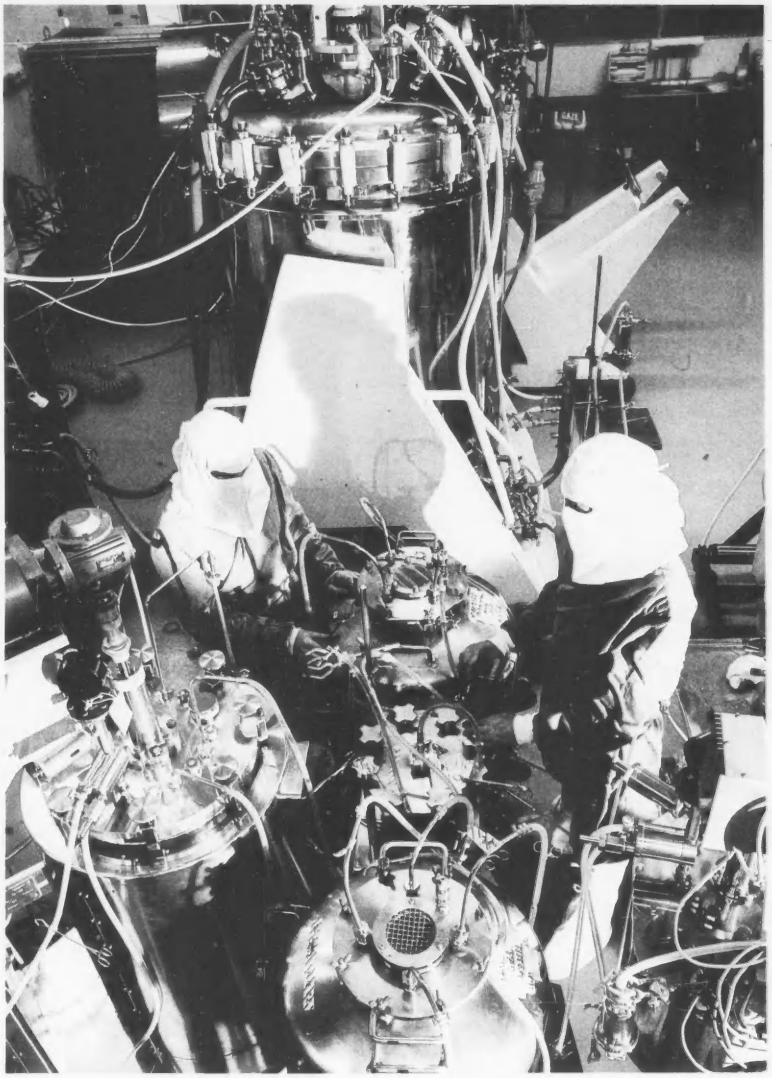


Photo Gloaguen © Rapho, Paris

Drugs in medicine

Different categories of drugs can be distinguished according to the purpose for which they are used:

Curative drugs, capable of completely curing a disease after administration for a specified time, are basically substances which are toxic to invading organisms in the body. These are the antibacterial, antiprotozoan and antiparasitic drugs.

Palliative drugs normalize body functions during the course of treatment. This category includes hormone substitutes as well as anti-inflammatory, cardiovascular and psychotropic drugs.

Symptomatic drugs suppress a symptom (which can be caused by different diseases). They include the analgesics, antipyretics, cough suppressors and drugs for diarrhoea.

Prophylactic drugs are in the main vaccines, but some antibacterials can also be included in this category.

Diagnostic drugs, such as those used in radiology, are only used by the doctor.

Placebos. The placebo effect is the positive therapeutic effect that some patients derive from a medicament whose active properties cannot be shown. Placebos constitute a large proportion of all drugs bought or consumed.

Source: Georges Peters, in *Santé, médicaments et développement*, Fondation Liberté Sans Frontières, Paris, 1987.

tions—clearly quite superfluous—of the same active ingredients. Between 250 and 1,500 pharmacologically active substances (depending on the country) are equally superfluous. These are substances of doubtful therapeutic value, "me-too" drugs,[2] new active agents which are more expensive and hence more profitable, traditional drugs (of national, colonial or folk origin) or medicines sold to treat non-existent diseases invented by the advertising departments of pharmaceutical manufacturers.

The only hope of satisfying the drug needs of the people of the developing world is to limit supplies to a restricted list of essential drugs, which could be based on the WHO *Model List*. This step would curb the present ruinous outlay from the poor countries and also avoid many errors made by prescribers and consumers, as well as many side effects, unforeseen incompatibilities and cases of drug dependence.

In many developing countries with a free market economy, the "national" list of essential drugs is enforced only in the "public sector", where drugs are bought by the State to be distributed free of charge or sold to the public. On the other hand, most of the medicines available on the European or American markets are distributed in the "private sector" of developing countries where drug manufacturers can sell everything that has been registered by the authorities and that they can get doctors to prescribe. Whereas the public sector is supposed to cater for the needs of the overwhelming majority, private medicine is usually accessible only to the well-to-do inhabitants of towns and cities, who represent between 1 and 7 per cent of the population. As most drugs are imported and foreign currency spending is limited, the private sector prevents adequate supplies from reaching the majority of the population. Furthermore, sick people who receive medical treatment from the public sector will tend to suspect that their government is depriving them of "good" medicines! Full benefit can therefore be derived from a restrictive list of essential drugs only if such a list applies to the private sector as well as to the public sector.

In order to avoid many errors arising from the plethora of trade names, and to prevent the manufacturers of a brand of drugs from making big profits out of it long after it has ceased to be protected by patent, it is also necessary to enforce the use of International Nonproprietary Names (INN), or the generic names of drugs, for both prescription and selling purposes. All that needs to be done is to stipulate that the generic names of the active ingredients of the drugs should be printed clearly and legibly on the package of each product, even if a brand name is shown as well.

Many governments of developing countries are endeavouring to set up national pharmaceutical industries in order to reduce their dependence on the developed countries. Most of them realize, however, that the establishment of a pharmaceutical industry requires heavy capital investment, that pharmaceutical plants yield returns only after a relatively long period and that ultimately they create very few jobs. None of the developing countries which have established pharmaceutical industries (with the possible exception of Brazil and India) has become truly independent in this field. The establishment of a national formulation and packaging industry merely changes the type of dependence, so that a country comes to depend on suppliers of chemical

2. *"Me-too" drugs*. Products similar to others already on the market. *Editor*.

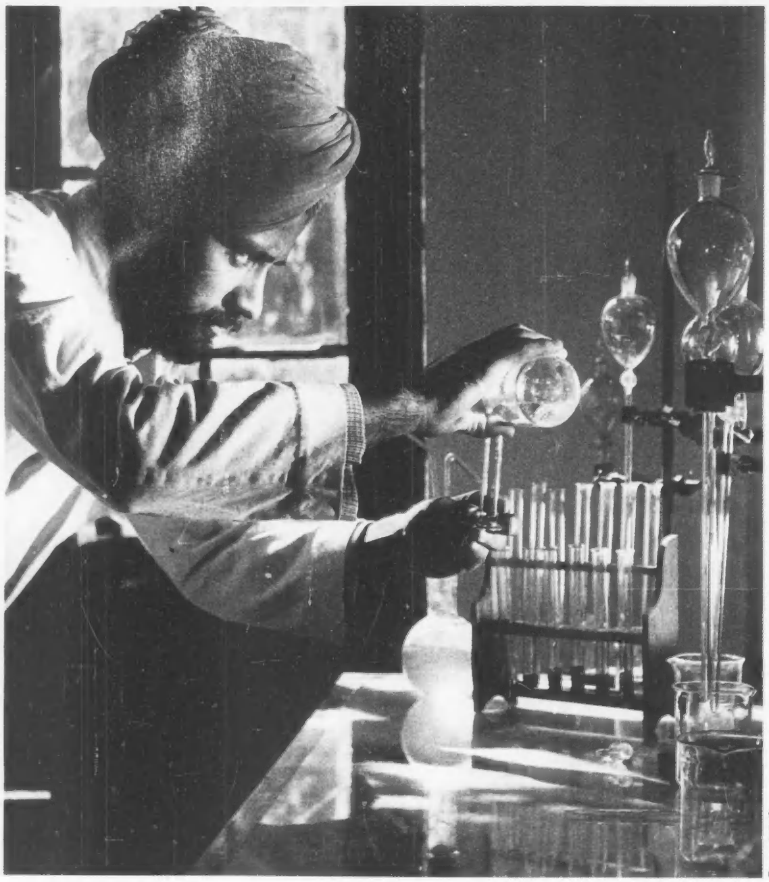


Photo WHO

The World Health Organization has drawn up guidelines for the quality control of pharmaceutical products. In developed countries, quality control is carried out by highly specialized national laboratories. Developing countries also need laboratory facilities, above, to prevent poor-quality drugs from reaching them, as a result of fraudulent practices, faulty manufacture, mislabelling, or exposure to high temperature and humidity.

raw materials, and hence on the chemico-pharmaceutical industries. In the case of pharmacologically active substances, monopolies are often more restrictive than for ready-to-use drugs.

In order to ensure that the population has an adequate supply of strictly necessary essential drugs, the developing countries will be obliged, for years to come, to import drugs or raw materials. If they are to avoid crippling expenditure, these countries must introduce a list of essential drugs and the use of International Nonproprietary Names. They will also have to equip themselves with the means of controlling the quality of imported drugs and endeavour to buy them as cheaply as possible by, for example, issuing international invitations to tender. Finally, they must educate their populations to use drugs more rationally, and ensure that those who issue prescriptions only do so when they are fully informed.

The pharmaceutical industries of the industrialized countries would be well advised, in the medium and long term, to support programmes of action for the introduction and rational use of essential drugs. Unfortunately, many of them set a priority on short-term profits and defend the private sector and protected brand names. These industries currently make around 8 or 9 per cent of their turnover in the developing world. If the developing countries were to become fully independent, the chemico-pharmaceutical industrial complexes would only lose part of this market because they would continue to supply a proportion of the raw materials.

The government of a poor country which is unable to obtain essential drugs on reasonable terms will have to seek other solutions. One of these is recourse to traditional drugs which call for no expenditure of foreign currency. These drugs encompass a vast range of products or plant extracts whose therapeutic effects have not, as a rule, been proved, whose composition varies from place to place and from year to year, and whose undesirable effects are still unknown. Huge investments of capital and labour are needed to enable a traditional drug to become one that is medically useful.

If such a movement were to become widespread, it could mean the end of pharmaceutical trading by industrialized countries in the developing world. Unfortunately, it could also extinguish the hopes of the populations of developing countries of receiving the medical care and drugs they really need. ■

Photo © Adrian Spalding

Poster © Voluntary Health Association of India

Poster produced by the Voluntary Health Association of India

GEORGES PETERS, *Swiss university teacher, is director of the Institute of Pharmacology, Lausanne University. He is a consultant with the Swiss Development Agency and with the World Health Organization. Among his many published works on medicine in developing countries is* Racismes et races *(1986; "Racism and races").*

580 million over 60s by the year 2000

A grand old age

by Edit Beregi

THE proportion of elderly people in the population as a whole is significantly growing. Between 1970 and the year 2000 the number of over-sixties is expected to rise worldwide from 307 million to 580 million. This increase presents physicians, biologists, psychologists, sociologists and social workers with new problems.

The prime objective of all gerontological research is to prolong the individual's active and productive life. During the last decade our knowledge of the changes wrought by the ageing process, as well as of the health problems, social needs, and medical requirements of the aged has substantially increased.

Ageing is a slow physiological process. Studies have shown that most organs of the body reach their functional peak between the ages of twenty and twenty-five years, thereafter remaining on this plateau for a considerable time. As the years go by, these functions decline in varying degrees. It has also been established that up to the age of seventy the incidence of these changes varies widely. Many people will retain their full capacities even to the age of seventy, their organs functioning as soundly as those of people half their age. In other cases, the decline in the functional efficiency of an individual's systems may have become so marked by the age of seventy as to require him or her to be taken into care.

Reduced functioning of organs lies at the root of many of the illnesses of the aged. At the same time, in assessing the different functions, it must be remembered that a person's lifestyle can profoundly affect the performance of his or her organs. Several studies have shown that an unsuitable diet, lack of physical exercise, tobacco smoking and the consumption of alcohol have an adverse effect on the functioning of some organs and contribute to the appearance of diseases associated with old age.

Industrial and technological progress has brought many benefits but also harmful effects such as an increase in diseases such as hypertension and arteriosclerosis, higher levels of physical and psychological stress and a greater incidence of disorders of the

nervous system. Rapid urbanization has led to environmental pollution, which in its turn has brought about an increase in the number of pulmonary complaints. Thus, over the last few decades, the type of diseases prevalent among the old has changed. Whereas at the turn of the century infectious diseases headed the list, nowadays chronic conditions have become the chief problem.

We still do not know how the state of health and lifestyle of the elderly will develop in the course of an extended lifespan. Different authors have different views on the subject. According to some, people will enjoy good health to the age of eighty-five, after which the organism is likely to deteriorate rapidly. In this view, death will occur from biological ageing rather than from chronic disease. By contrast, others foresee a protracted loss of functions and increasing incapacity, leading to a marked rise in the number of the chronically sick. They deem it essential therefore for medical science to address the problem of how to improve the last period of life. Yet others hold that a longer healthy lifespan can be expected with an extension of the middle "second age". Studies also find that seventy-five-year-olds today are healthier than were their counterparts ten years ago. This change is the result of preventive measures against the usual ailments of the elderly.

Recent results of research and technological progress have drawn attention to many opportunities and tasks involved in efforts to improve the quality of life of the elderly.

Pride of place must go to the need for a change in lifestyle. Adoption of a correct lifestyle must come, however, at an early age, for, apart from hereditary factors, the health of the elderly is largely determined by their mode of life in younger years. An incorrect lifestyle can give rise to illness even in a person's youth, which will then be carried over into old age.

Modern technology can assist in the early diagnosis of some diseases and help to ensure that treatment of a chronic condition begins in good time. Many diseases can now be successfully treated in their initial stages, thereby avoiding subsequent complications. The success of early treatment is proven by the fact that where screening for and early treatment of hypertension has been introduced, the incidence of stroke and myocardial infarction has significantly decreased.

Photo WHO Interphoto

An 80-year-old Hungarian athlete gives an impressive demonstration of gymnastics to a youthful audience.

New ways must be sought of promoting mental health, and new aids must be developed to improve mobility and the functioning of the sense organs in the elderly. Active life is often impeded in old age by diseases of the joints, by impaired hearing and poor eyesight. Provision must also be made for organ transplantation in the elderly.

Another crucial task is to find ways of influencing the changes which accompany the biological ageing process and of counteracting its effects. Attempts have already been made to inhibit these changes or to retard their appearance, but as yet, no definite conclusions applicable to human beings can be made. It remains for future studies to determine how the results of basic research might be applied in practice.

In the light of our present knowledge, preventive care is the only way in which we can retard biological ageing and the incidence of the ailments associated with advanced age, while at the same time ensuring active and productive old age. The following preventive steps are feasible:

* Early diagnosis of the diseases likely to occur in the elderly and their timely treatment. This will ensure that those approaching old age will do so in good physical and mental health. Early diagnosis is facilitated by a number of screening techniques, which makes them valuable aids in geriatric medicine.

* Another useful aid in preventive care is preparation for retirement with a view to safeguarding the individual's physical and mental well-being and minimizing the psychological stress of retirement. Such preparation should begin around the age of 50 since at that age the personality has not yet become too rigid.

* The third preventive step is based on awareness of the importance of a healthy lifestyle, of a correct diet, of the need for physical exercise, and the adoption of a sensible life routine in keeping with the state of retirement. Attention must be paid to the right amount and right kind of rest to be incorporated in the day's activities. At the same time, the importance of the preservation of an active mental life through stimulating pastimes must be kept in mind. Guidance should be given about relieving elderly people of physical burdens, while fully preserving those activities which do not impose a strain on them.

* A novel idea in preventive geriatric medicine is that of the University of the Third Age which can make a valuable contribution to the promotion of an active life, the maintenance of alertness and the provision of useful leisure activities among the elderly.

Further advances in science and technology, as well as conscious preparation for old age, give grounds for hope that by the turn of the millennium the large percentage of old people in the population will be able to lead a healthy and active life, their main concern being how to make the best use of their new-found years of freedom. ■

EDIT BEREGI, *of Hungary, is director of the Gerontology Centre at the Semmelweis Medical School, Budapest, where she also teaches. She is a member of many international medical associations, including the WHO Expert Advisory Panel on the Health of Elderly Persons, and the Board of Directors of the International Centre for Social Gerontology (CIGS), based in Paris. She is the author of many scientific articles and of four books on gerontology.*

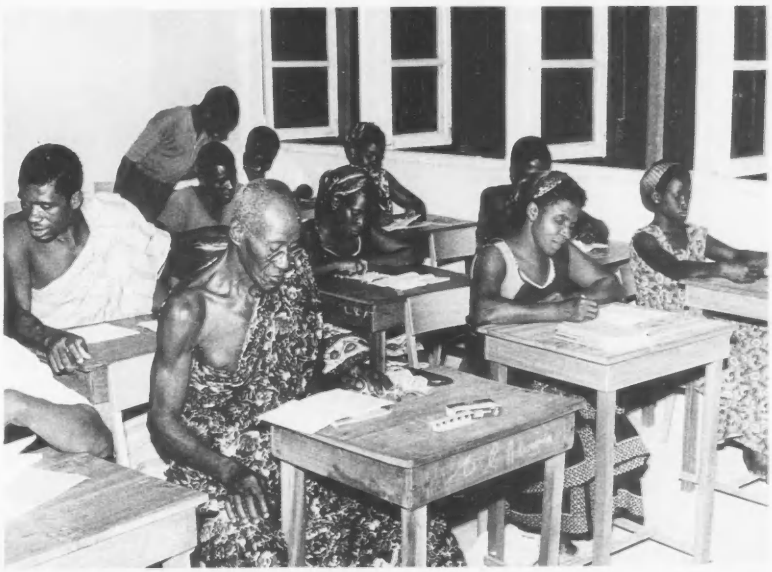


Photo Unesco, Paris

Education and later life is one of the themes of a major Unesco programme, *Education for All*. Activities in this field focus on preparation for retirement, the development of educational activities for the elderly, and using the potential which elderly people possess to help meet educational, social and cultural needs.

Photo © CNRI, Paris

In nuclear magnetic resonance (NMR) scanning, one of the most refined techniques of medical investigation, the patient is placed in a powerful magnetic field that has a profound effect on the protons (nuclei of hydrogen atoms) in the body. These protons normally point in random directions, but inside the scanner's magnetic field they align themselves in the direction of the field's poles. When the scanner excites them with a radio pulse, it knocks them out of alignment. Within milliseconds they spiral back into place, emitting a "signal" which varies according to the composition of the tissues under observation. A computer translates the signal into an image on a video screen. NMR gives an extremely precise anatomical picture, as in the high definition image of the brain, above.

IN his laboratory at the Hôtel Dieu, a leading Montreal hospital, a young Canadian cancer specialist is experimenting with a technique which may be in everyday use before the year 2000: the location, on a video screen, of the metastases (secondary or mini-tumours) of a patient suffering from breast cancer.

The technique owes as much to biology as it does to video equipment and informatics, since it uses antibodies specially designed to identify cancerous cells in a very specific manner. These "monoclonal" antibodies, as they are called, are "tagged" with a radioactive substance. Injected into the patient, they home in and lock on to the metastases, however small they may be, which can then be pin-pointed with the aid of a special, radioactivity-sensitive camera.

"It is our hope," the Canadian doctor explains, "that with the help of this technique we will one day be able to detect metastases wherever they may be within the body. Our dream is that we will then be able to attach a few molecules of an appropriate medicament to these monoclonal antibodies which will deposit them directly at the site of the tumour ..."

In a laboratory at Mama Yémo Hospital, 8,000 kilometres away in Kinshasa, a team of doctors and researchers working on the Zaire AIDS Research Project (Projet SIDA) have taken up another challenge: they are attempting to perfect a cheap but reliable test to detect the presence of AIDS virus antibodies.

The test currently in use costs a minimum of $3 a time, a "luxury" which no poor country can afford for a comprehensive screening programme. The researchers in Zaire are seeking to develop a test which would be one hundred times cheaper. This would make it possible to test all blood received from blood-donors and thus ensure the safety of the blood transfusion service, an essential weapon in the medical

Tomorrow's medicine

by Yanick Villedieu

armoury, but which, today, is still implicated in the spread of the AIDS virus in Africa.

Montreal and Kinshasa. Two snapshots of the medicine of today and two facets of the medicine of tomorrow—one sophisticated, at the leading edge of progress; the other, equally fascinating, the medicine of daily life. Two worlds with but a single purpose—to help the sick to the best of the capabilities of science and technology ... subject to the constraints of time and place.

Molecular medicine

The monoclonal antibodies of Montreal and the AIDS virus test of Kinshasa are but two of the amazing possibilities within the range of modern medicine. From the 1950s on, following breakthroughs in biology and molecular genetics, researchers have concentrated on unravelling the mysteries of the functioning of the human organism in ever more minute detail.

From observation of a particular organ and its function, they have gone on to seek to understand its internal mechanisms. They have penetrated deep into the heart of the cell, analysing the subtle chemistry of life and decoding the score that governs the fabulous orchestration of the genes. In so doing they have discovered dozens of genes that control the manufacture of the hormones, peptides and proteins that are essential to the proper functioning of the human organism ... and at times are responsible for its malfunctioning. They have found out how a molecule enters a cell to feed it, to deliver a message, or to destroy it. And since the genetic code is universal, as applicable to a bacterium as to an elephant, they have also uncovered the secrets of multitudes of microbes, viruses and other parasites.

The biology of today will be an important constituent of the medical science of tomorrow. Progress in one leads to advances in the other. A few years ago, for example, Canadian researchers discovered a hormone secreted by the heart which plays an important role in the control of blood pressure. Since then, teams of Japanese, American, Canadian and European researchers have been battling fiercely to find applications for this discovery, since the heart hormone, it would seem, may well turn out to be the model on which all future treatment of hypertension will be based.

Progress in molecular medicine, as scientists like to call it, is beginning to make its influence felt in the field of hereditary health problems. In some cases, pre-natal diagnosis can detect an anomaly in the foetus which would indicate the advisability of therapeutic abortion. In other cases, early diagnosis of a problem makes it possible, a few days after a birth, to start treatment which would be too late if it were left until symptoms appeared. Finally, a great leap forward has been achieved with the arrival of "molecular probes", which will become widely available during the coming decade. Using these probes it is now possible to detect the presence of defective genes in parents who, unknown to themselves, are carriers of the defect. Applied where there is an exceptionally high risk of hereditary problems, such probe tests will enable improved genetic counselling to be given.

This is not all. Genetic medicine has applications beyond the field of hereditary illness in the conventional meaning of the term. The gene involved in cancer of the retina has recently been identified and genes thought to be implicated in Alzheimer's disease and depression have also been discovered. Many research workers believe that, in the not too distant future, the genes involved in such common illnesses as atherosclerosis, diabetes, some cancers and certain neurological problems may also be found.

One day, perhaps, we shall learn how to heal or replace defective genes. What is envisaged in the more immediate future is the emergence of a form of predictive, individualized medicine which will make it possible to adapt general health advice to meet the specific needs of each individual, having regard to his or her susceptibility to, for example, lung cancer, heart attack, obesity or depression—a kind of preventive medicine à la carte.

Mapping the human brain

The next decade will witness a surge of research interest in the brain, which has already displaced the gene as the new frontier of medical science. The stock of scientists with specialist knowledge of the noble organ is rising on the world "grey matter" market. Founded in 1971 by 500 North American researchers, the Society for Neurosciences now has 10,000 members. Another sign of the times is that the greatest research institutions in the United States, from New York to San Diego, have recently established centres specializing in brain research, endowed, moreover, with considerable resources.

The boom in neuroscience is neither fortuitous nor the expression of a sudden fad. For several years now researchers in this field have achieved prodigies of pioneering work. They have discovered the functions of the different regions of the brain, described the complex tangle of the neurons and observed anomalous conditions so as to learn more about the normal functioning of the most inaccessible of human organs. They have discovered substances that regulate the waking and the sleeping states, manage the emotions, control pain, govern sexual desire or the will to power, and cause anomalies of behaviour, temperament and memory.

Acquiring mastery of the amazing chemistry of the brain has been, and will continue even more intensely to be, the priority objective of the neurosciences. One example, by no means the most recent, was the discovery that Parkinson's disease was due to a lack of one of these chemical substances, dopamine. Later it was found that the condition of sufferers could be alleviated by the administration of L-dopa (a substitute for dopamine which has the capacity to penetrate the barrier which envelops and carefully guards the brain).

The brain is an electronic as well as a chemical machine, a super-computer whose circuitry we are now able to study. A researcher in Denmark is studying the cerebral activity of individuals undertaking mental operations. Using apparatus that can detect the consumption of oxygen within his subject's brain, he can have the curious experience of "seeing a brain think" on a video screen (see back cover).

We are still very far from having penetrated all the secrets of the brain. But things are already happening. In Sweden, a few years ago, and more recently in Mexico, surgeons attempted to restore full function to the brains of sufferers from Parkinson's disease. They took cells that produce dopamine from glands situated in the kidneys of their patients and transplanted them into their brains. While the results achieved in Sweden were disappointing, those obtained in Mexico were very positive. It is said that the brain, with all its dizzying complexity, will never be able fully to comprehend itself. It will soon, however, be able to "repair" itself.

"Pseudo-hormones" and high-tech vaccines

Two other branches of biology, endocrinology (the science of hormones) and immunology (the science of the immune system), are experiencing an unprecedented boom. Stimulated by genetic techniques, aided by new instruments for the exploration of the infinitely small, and with the backing of the pharmaceutical industry which has recognized their enormous potential, they are beginning to "deliver the goods".

In universities and private laboratories, thousands of men and women in white coats are concocting a profusion of products with exotic names—prostaglandins, neuropeptides, immuno-regulators, anti-carcinogens, monoclonal antibodies. ... Some of the products, such as interleucines (regulators of the immune system) and, above all, interferon, have achieved star status before even having become medicines in the strict sense of the word. Sooner or later, several of these products will be ▶

The challenge of AIDS

Acquired Immunodeficiency Syndrome (AIDS) and all the diseases associated with human immunodeficiency virus (HIV) infection have in the space of a few years become a matter of great concern to the international community. The disease has taken on pandemic proportions, creating a worldwide emergency of which public health officials, doctors, politicians and the public at large must be made aware.

AIDS was recognized for the first time in 1981. Since then the number of cases has increased considerably. By the end of June 1987 over 52,600 AIDS cases had been reported to the World Health Organization (WHO) by 118 countries. However, according to WHO estimates, the number of cases is higher than 100,000, and worldwide between 5 and 10 million persons may now be carriers of the HIV virus.

"AIDS robs societies mainly of 20 to 49 year-olds, men and women in their most productive years. This has potential for economic and political destabilization in the severely affected parts of the developing world," according to Dr. Jonathan Mann, Director of the WHO Special Programme on AIDS. "To the loss of human potential must be added the extraordinary financial burden of an incurable disease. A problem of this magnitude demands a global response, in which WHO has a constitutional responsibility to direct and co-ordinate the struggle against AIDS."

National AIDS Committees have already been established in more than 100 countries. Between January and May 1987, WHO supported 40 countries, including 25 African countries, in the development of prevention and control programmes. By the end of the year, the WHO Special Programme on AIDS will be supporting 40 sub-Saharan and a further 30 countries in Asia and the Americas.

International collaboration organized by WHO includes the establishment of banks for viruses and sera, studies of the epidemiology of the disease and the different criteria—logistic, technical, economic, social and ethical—which screening programmes must satisfy. A world summit of health ministers will be held under WHO auspices in London in January 1988, as a follow-up to two regional ministerial meetings in Australia (July) and in the Americas (September). Finally, given that "AIDS thrives not only in the body, but on human ignorance, fear and resistance to change", WHO launched a global public information campaign on 27 May 1987, with the message: "AIDS. A worldwide effort will stop it." This theme and the symbol that illustrates it (two red hearts that converge in a blue fright mask) were chosen, said Dr. Mann, to "simultaneously communicate the severity of the AIDS threat and that a global strategy can control it". This strategy "is to stop the spread of AIDS worldwide by striking every way the virus spreads, in every country, using every scientific and educational tool available".

Unesco has always actively encouraged "preventive education" and in this field has developed programmes designed to eliminate prejudice and intolerance, to prevent or contain environmental deterioration, to prevent unplanned fertility, and to combat drug abuse. A number of these activities have been carried out in close co-operation with other United Nations agencies. Unesco is thus well placed to support WHO's strategy for AIDS prevention and control and to mobilize educational authorities and teaching personnel.

In December 1986, Unesco was invited by the International Conference on Education to prepare "as a matter of urgency and in co-ordination with other competent bodies in the United Nations system, a draft emergency programme of education and information in schools for AIDS prevention". Accordingly, a meeting of experts was held at Unesco Headquarters in Paris from 29 June to 1 July 1987, in order to work out the details of a joint Unesco/WHO plan of action, which will be submitted to Unesco's General Conference in October 1987. ■

reinforcing the armoury of hospital medicines and may even be available at the local pharmacy.

Prostaglandins, for example, are "pseudo-hormones" derived from fatty acids. They are to be found almost everywhere in the body. They constitute an already large family—including, for example, leucotrienes, thromboxane and prostacycline—some members of which may soon become as well known as aspirin. Their role as medicines is seen as being in the prevention of heart attacks and the formation of ulcers, and in the treatment of inflammation and of asthma.

Interferon, interleucines, prostaglandins, hormones of the brain and of the heart are all natural substances that can now be synthesized in large quantities after gene cloning. They can even be produced by bacteria that have been genetically re-programmed. Insulin, interferon and the growth hormone are already produced commercially in this way.

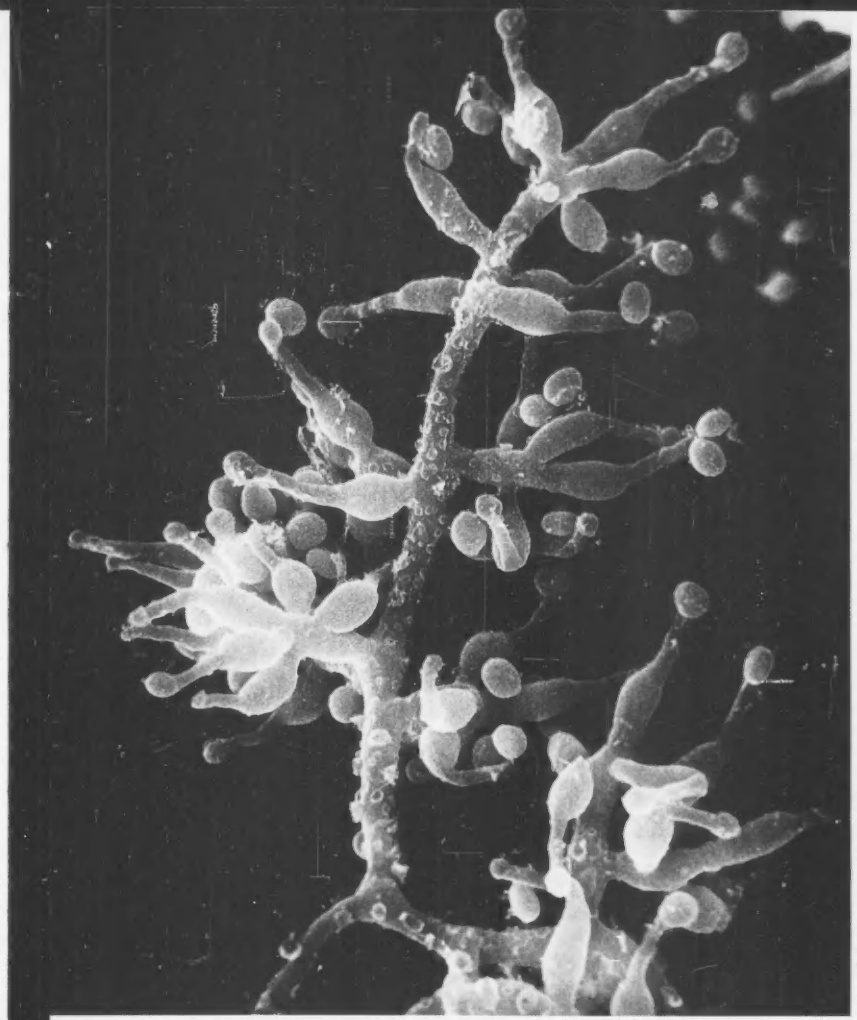
The good old vaccines of long standing will also benefit from the latest genetic techniques. Once its structure is known, an antigen (the part of a microbe that stimulates the formation of antibodies) can be produced artificially by chemical synthesis or by re-programmed bacteria. Some vaccines, which are manufactured in a rather crude, empirical fashion, will soon be produced using the most modern techniques, just as will new vaccines. American researchers are relying on genetic engineering to provide a vaccine against malaria which they see as the next important breakthrough in preventive medicine—the next, that is, unless the eagerly awaited vaccine against AIDS overtakes it to become the very first great high-technology vaccine in medical history.

A revolution in medical imaging

The medical science of tomorrow will not, however, stem solely from biology. Electronics, informatics, the science of materials and nuclear physics will also have a large part to play.

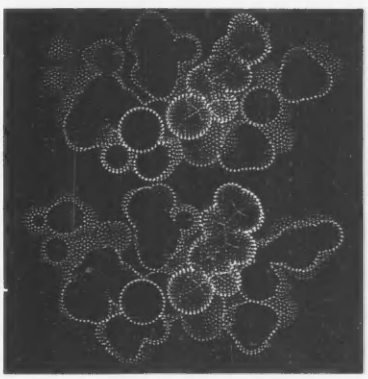
Lasers are already making their contribution to delicate surgical procedures such as eye operations, and tomorrow a laser attached to the end of a flexible wire will be used to unblock clogged arteries.

Computers, with their artificial intelligence, are helping doctors to make their diagnoses and chemists to design molecules to achieve specific pharmacological effects. Used in conjunction with video cameras, axial tomography, magnetic nuclear resonance and echography, they are making their contribution to the revolution in medical imaging which is making it feasible for



1 **Understanding of immunological mechanisms and a breakthrough in the development of immunosuppressive drugs have given a significant boost to organ transplantation and opened up new horizons in treating many formerly incurable autoimmune diseases. (1) spores of the fungus *Tolypocladium inflatum*, from which the powerful immunosuppressive agent cyclosporine is produced. (2) crystal of synthetic cyclosporine. (3) computer-generated view of natural cyclosporine and a synthetic derivative (below).**

Photos © Sandoz Laboratories, Basel



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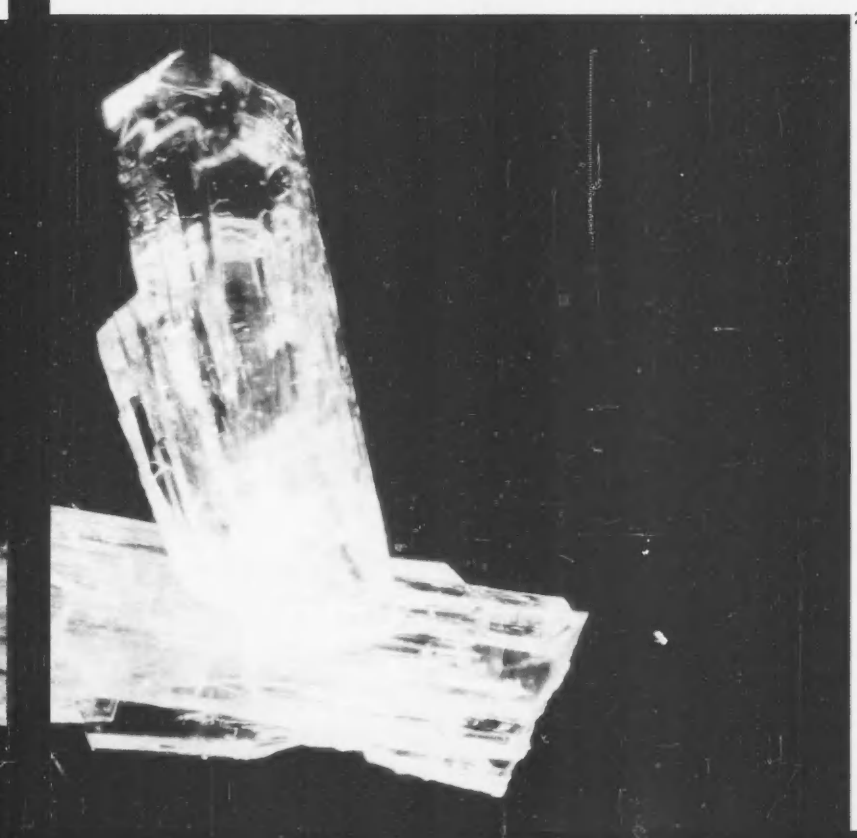


2

doctors to explore the brain of a schizophrenic, the heart of a cardiac sufferer or the belly of a pregnant woman in a way never possible before. These "non-invasive" techniques are destined to have a major effect on medical practice in coming years, particularly in the field of diagnosis.

When it is too late to prevent or to heal, then it is a matter of replacing the affected part. Already artificial hearts are plugged in, admittedly without great success. Tiny miracles of electronic wizardry are implanted in the inner ear to make the deaf hear. Knees, ankles, fingers and skull-cases are rebuilt. Artificial skin and blood, hydraulically operated walking machines, motorized arms which respond to the wearer's nerve impulses, electronic hands covered with sensitive artificial skin, all these are already on the test-bench. Tomorrow, this "spare-part surgery" will be able to offer artificial replacement muscles, larynxes, sphincters, nerves, pancreas and intestines—at least to those who can afford them.

Social and preventive medicine

New medicines and vaccines, decisive progress on cancer and cardio-vascular diseases, access to genes and to the brain,

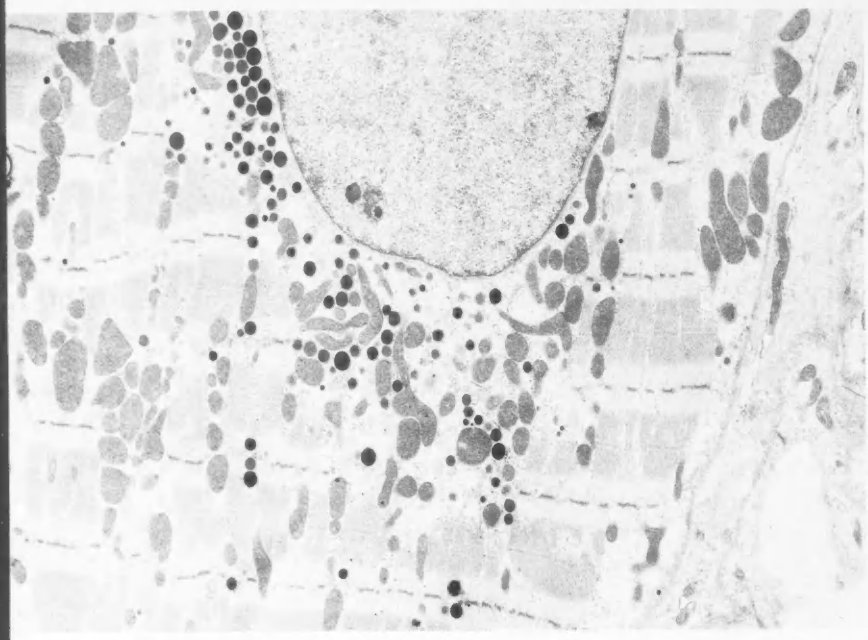


Photo Marc Cantin © *Scientific American*

It has recently been discovered that the heart is more than a pump: it is also an endocrine gland that secretes a hormone which regulates blood pressure and blood volume. Synthesis of this hormone, which in the body is stored in granules around the nuclei of cardiocytes (heart-muscle cells), could lead to new treatments for hypertension and other blood-pressure diseases. Above, an electron micrograph showing the hormone-storage granules (enlarged 12,000 times) in a cardiocyte of a rat.

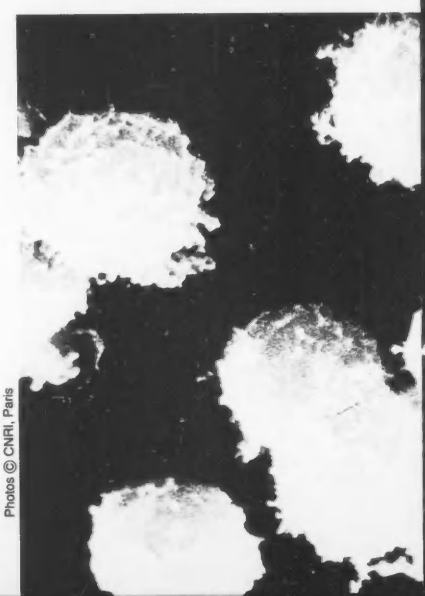
grafting made commonplace, more effective artificial organs, all these will be the stuff of the medical science of tomorrow.

We must not, however, allow ourselves to be dazzled by the promise of advanced technology. Even more than today, medical science will have to come to terms with a new phenomenon—the intervention of ethical considerations. New techniques to assist human reproduction have already aroused passionate debate and will confront society with difficult choices. Science alone cannot answer the questions raised about the new techniques for prolonging life and the counter problem of the right to a dignified death. The field of action of genetic engineering will have to be clearly marked out if we are to avoid, for example, the false trails of eugenics. The immense cost of such innovations as the artificial heart will also pose delicate problems of social justice and the allocation of medical resources, not only in those countries where experiments in this field are being carried out, but throughout the world.

It is not enough for the medical science of the future to be merely futurist. It must also always be concerned with education, prevention, hygiene, the cleansing of the environment, proper supply of drinking water and food, adequate housing, the immunization and schooling of children.

On both sides of the North/South divide, the primary concern of medical science will always remain those tasks which, because they are not spectacular, we tend to think of as simple or humdrum and yet which are more difficult by far to carry out than the cloning of a gene or transplanting of a heart. ■

There is continual feedback between the cells of the nervous system (above right, neurons) and those of the immunological system (below right, lymphocytes) in which neuropeptides, endorphins, hormones, lymphocines and interleucines act as chemical messengers. These interactions have been extensively studied by molecular biology, a field in which Unesco has for many years encouraged international co-operation. The International Brain Research Organization (IBRO), which promotes neuroscientific research, was founded under Unesco auspices in 1960, and in 1962 Unesco was instrumental in founding the International Cell Research Organization (ICRO), which helps to train young scientists worldwide.



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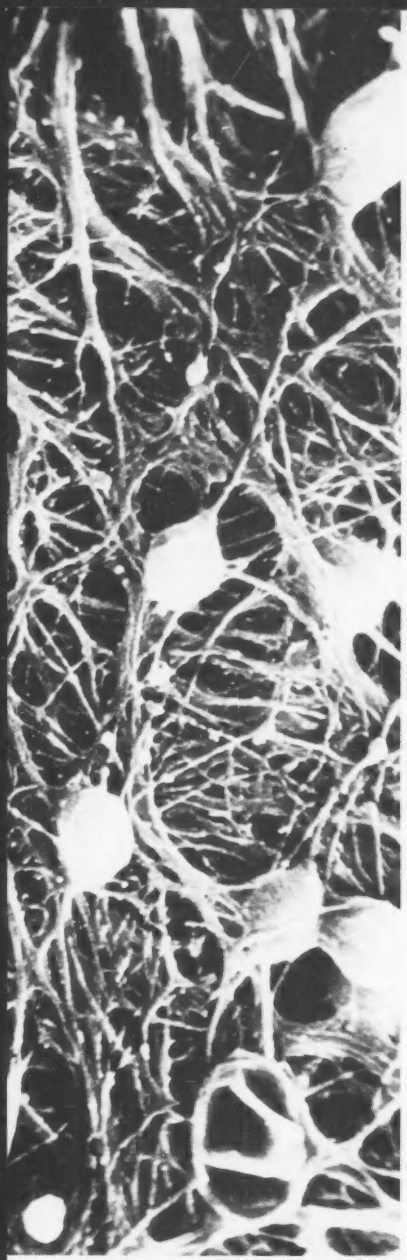
YANICK VILLEDIEU, *Canadian scientific journalist and broadcaster, has written many articles and reports on different subjects, notably medicine and health. He has also been involved in professional and academic meetings and seminars in the field of public health and medicine. Among his published works are* Demain la santé *(1976; "Health Tomorrow").*



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Automation and microsurgery

by Svyatoslav Fedorov

A team of surgeons apply assembly line principles in the "Clear Sight" operating theatre (above)at the Moscow Scientific Research Institute of Eye Microsurgery.

THERE are almost 30 million blind people in the world and nearly 1,000 million others who have to wear spectacles. The revolution now under way in the treatment of such common eye diseases as cataract, myopia, hyperopia and glaucoma is associated with achievements in eye microsurgery.

The first implantation of an artificial lens in the eye took place in the late 1940s, but unfortunately, early implantation attempts proved a failure, with the result that the technique came to be regarded as scientifically unsound. However, research in this direction continued in the USSR and the technique was not only "rehabilitated" and perfected, but also came to be used on a mass scale.

Artificial lens implantation is now one of the most widespread surgical operations in the world. There are numerous kinds of artificial lenses, of which a posterior-chamber lens implanted in a very narrow space between the iris and the capsule of the removed lens, has proved to be most effective. Various models of this kind of lens have been developed since 1975. The most popular is the posterior-chamber lens which is fixed directly within the capsule of the natural lens. As the artificial lens does not come into contact with any structure inside the eye, such as the iris, the patient recovers more quickly. Nearly two million posterior-chamber lenses have already been implanted throughout the world.

However, we are not yet satisfied with the existing models of intraocular lenses. Research is going on to make the artificial lens lighter and more pliable, and to ensure a perfectly smooth surface. Until recently all lenses were made of acrylic plastic, the physical and chemical properties of which did not allow the production of a light, pliable yet durable artificial lens. Then silicones (biologically inert polymers) were discovered. They meet all the necessary requirements, since they are elastic, have a high chemical and heat resistance, and are already widely used in medicine, particularly in haematology and cosmetic surgery. The major advantage of a silicone lens is that patients are no longer faced with post-operative complications which can follow the implantation of a hard acrylic plastic lens.

It is now possible to envisage intraocular lenses made of liquid silicone, which could be injected into the lens capsule and polymerized there without losing their elasticity.

The next step in the intraocular correction of vision may be an artificial lens equipped with a solar battery which will provide it with refractive power, i.e. the ability to accommodate or adjust its thickness for far or near vision. A person with such a controllable lens will not have to wear spectacles at all, whereas today people with artificial lenses still have to wear them while working or reading.

Myopia, or nearsightedness, affects some 800 million people. A technique for surgical correction of myopia has been developed in the Scientific Research Institute of Eye Microsurgery in Moscow. It consists of cutting a collagen molecule, which causes it to regenerate itself, i.e. produce a new molecule

to replace the destroyed one, thus changing the elastic properties of the cornea. Under intraocular pressure, the portion of the cornea at the site of the cut becomes convex and the central part flattens. As a result, the image is properly focused on the retina. Using this method, we correct myopia of -1 to -14 dioptres.[1] Twenty-five thousand such operations have been performed at our Institute, and nearly 300,000 throughout the world. Molecular surgery opens up unprecedented opportunities for the treatment of other organs as well.

For several years we have also been successfully treating hyperopia, or farsightedness, with surgical techniques. Today, we are able to correct the vision of those wearing spectacles of +1 to +8 dioptres.

Contemporary medicine has a great need for more reliable and efficient methods of treatment, including the establishment of large "health factories" specializing in therapy of major diseases. The introduction of the industrial principle into health care involves the division of the process into stages, each of which is the responsibility of a specialist. This principle is applied at the Institute, where the work is distributed among surgical teams in an operating theatre which we call the "automated sight-recovery line" or "clear sight conveyor". As each surgeon finishes part of the operation, a signal is given and the operating table smoothly moves to the next surgeon.

It may seem rather inhuman to move a patient like a component along an assembly line, but each operation is carried out according to an individual plan prepared after a preliminary check-up. A computer designates the optimum surgical procedure, predicts the result of the operation and determines to what extent the eyesight of each patient can be improved.

The same surgical team carries out the preliminary check-up, performs the operation and provides post-operative treatment. Television monitors transmit each stage of the operation in colour, which is particularly important for ophthalmic surgeons. A video camera attached to the surgical microscope films everything the surgeon sees and automatically records the operation.

The number of operative and post-operative complications has decreased nearly tenfold using this automated approach, while each surgeon's productivity has increased five-fold. Furthermore, the industrial principle, while ensuring the excellent quality of surgery, is very economical. Thus resources can be used to improve the facilities of the complex and to increase the number of patients treated.

Future developments in the industrialization of medicine include a project for a new out-patient clinic equipped with a diagnostic conveyor which would provide maximum comfort while reducing the time of examination from two days to two hours. A robot which would be able to treat myopia better than a surgeon is also at the design stage. But can the human eye be entrusted to an "unintelligent" robot? Yes, because the freedom of movement of the human hand is approximately 12°, an "excessive" freedom which is conducive to error. But a robot possessing only 2° or 3° of freedom of movement can be programmed to exercise a predetermined pressure on the eye and will be able to move its hand only within accurately verified limits. Continuous feedback is also possible during the operation to exclude any unexpected complications during surgery, for example, the robot could transmit information on the thickness of the cornea. ■

1. Dioptre: unit for measuring the refractive power of a lens. *Editor.*

SVYATOSLAV FEDOROV, *the founder of Soviet eye microsurgery research, is Director General of the Scientific Research Institute of Eye Microsurgery in Moscow. A corresponding member of the USSR Academy of Medical Sciences, he is the author of more than 300 publications, including "Artificial Lens Implantation" (1977), and the co-author, with E. Yegorova, of "Surgical Treatment of Traumatic Cataract" (1983).*

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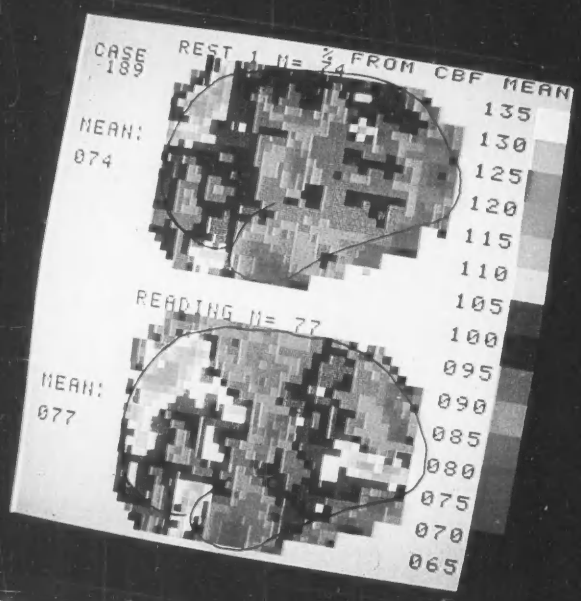
Watching the brain work

Computerized imaging techniques are today being widely used in clinical diagnosis and medical research. Spectacular results, notably in the study of the brain, have been produced by introducing radioactive substances into the body and using radiation detectors to record their behaviour. By revealing changes in the pattern of cerebral blood flow, this technique makes it possible to watch the brain at work. Images in photo 1 show part of the brain of a person at rest (above) and reading silently (below). In photo 2 the subject is resting with eyes closed (above) and reading aloud (below). Photo 3 shows the brain of an epileptic person during a seizure (below) and in a seizure-free period (above).



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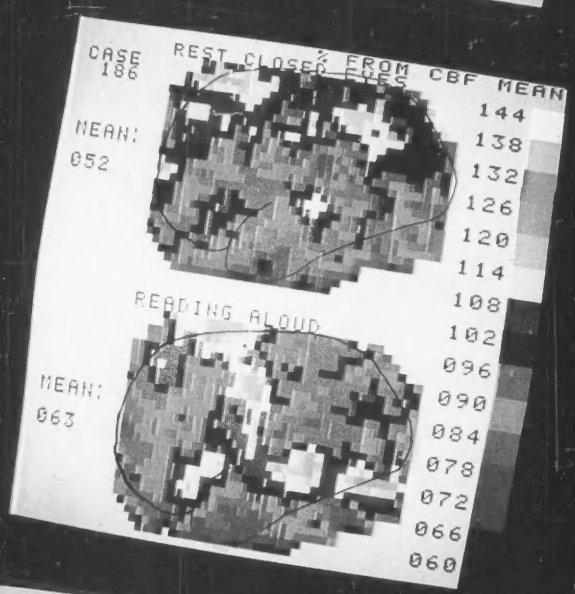

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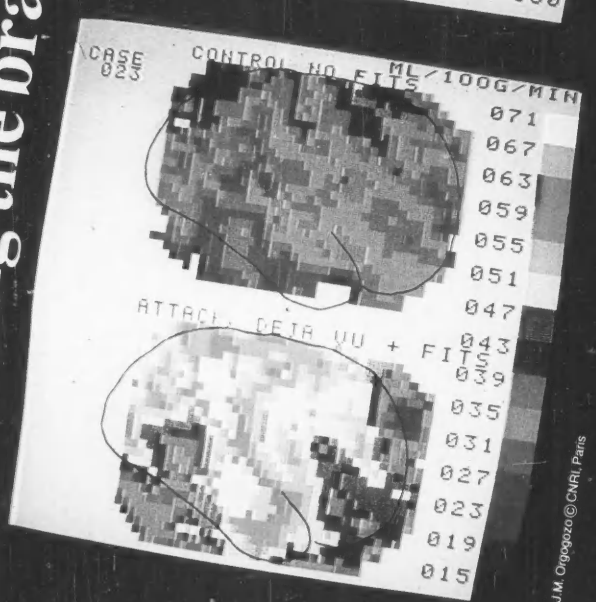

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